A STATEWIDE ASSESMENT OF AREAS TRENDING URBAN IN GEORGIA AND THE IMPLICATIONS FOR TRANSIT FUNDING

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A STATEWIDE ASSESMENT OF AREAS TRENDING URBAN IN GEORGIA AND THE IMPLICATIONS FOR TRANSIT FUNDING

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LIST OF SYMBOLS AND ABBREVIATIONS

ACS	American Community Survey
CA	Cellular Automata
GDOT	Georgia Department of Transportation
ESRI	Environmental System Research Institute
FAST	Fixing America's Surface Transportation
FORPH	Federal Office of Rural Public Health
FTA	Federal Transit Administration
MSA	Metropolitan Statistical Area
NTD	National Transit Database
NHGIS	National Historic Geographical Information Systems
OMB	Office of Management and Budget
RUCA	Rural Urban Commuting Area Codes
UC	Urban Clusters
UN	United Nations
US	United States
USDA ERS	United States Department of Agriculture and Economic Research Services
USGA	United States Geographical Survey
UZA	Urbanized Area

SUMMARY

There are two main sources of funding for public transit that depend on Decennial Census populations. Rural (urban) transit funding is for areas with populations less than (more than) 50,000. Urban funding is further classified into small urban and large urban areas depending on whether the population is less than or greater than 200,000. Only rural and small urban areas can use their transit funding for operating assistance. Given funding is tied to Decennial Census populations, it is important to understand how transit funding may be impacted by changes in population from 2010 to 2020. The purpose of this research is to estimate the impacts of urbanization on rural public transit funding for Georgia.

This study predicts which areas in Georgia will be reclassified from rural to urban in the 2020 Census using 2020 population projections from the Weldon Cooper Center for Public Service and the Environmental Systems Research Institute (ESRI) and data from the US Census Bureau. Three urbanization scenarios are modeled at the Census block level using a multinomial logit regression. The results suggest that the model correctly predicts 93.5 percent of the cases and most influential variables are population density and an indicator variable equal to one if the block is within the Atlanta Metropolitan Statistical Area (MSA). The mapped results indicate that outward urban growth might lead to multiple urban clusters and urbanized areas merging, especially around the Atlanta Urbanized Area. Urbanization trends in Georgia could cause at least seven counties to transition from rural transit funding to large urban transit funding. This is important, as rural areas that merge into the Atlanta area will lose operating assistance for public transit after 2020. In addition,

results suggest at least thirteen counties will be eligible for a mix of rural and small urban funding.

CHAPTER 1. INTRODUCTION

1.1 Background

The urban population and land area in the United States grew by 12.1 percent between 2000 and 2010. As the urban population grew, so too did the urban land area. Between 2000 and 2010, the urban area boundaries expanded and the bordering areas were reclassified from rural to urban, resulting in a two percent increase in urban land area across the United States (FORH 2017). When areas are reclassified from rural to urban, they become eligible for different public transit funding sources. For example, rural areas with a population less than 50,000 are eligible for Federal Transit Administration (FTA) § 5311 (rural) formula grants, whereas urban areas with populations greater than 50,000 qualify for FTA § 5307 (urban) formula grants (NTD 2017). FTA § 5307 funding is further allocated to small urban and large urban areas depending on whether the population is greater or less than 200,000.

The major difference between the FTA § 5311 and FTA § 5307 formula grants is the federal funding match for operating assistance. Rural and small urban (areas less than 200,000) can use up to 50% of FTA § 5311 or § 5307 funding for operating assistance, whereas large urban areas cannot. This causes large urban areas to be more depended on local funding sources for transit (FTA 2017).

In 2015, the Georgia Department of Transportation (GDOT) identified ten counties in Georgia that currently receive FTA § 5311 rural transit funding but are trending urban and likely will not be eligible for rural funding after the 2020 Decennial Census (GDOT 2015). GDOT anticipates shifts in transit funding eligibility will result in a loss of federal funding for public transit operating assistance across the state.

1.2 Problem Statement and Research Objectives

FTA will continue to use 2010 Census data to determine rural and urban public transit funding allocations until the 2020 Decennial Census is released (FTA 2014). After the 2020 Census, areas that are reclassified from rural to urban will need to switch their federal public transit funding source from FTA § 5311 to FTA § 5307. Depending on how quickly an area is urbanizing, it might be required to transition to either FTA § 5307 small urban or FTA § 5307 large urban. Areas that transition between funding tiers might experience a gap in funding due to changes in local match requirements and competitive formulas that prioritize areas with larger populations that have existing service in an urban area (FTA 2015).

To assist transit agencies in planning for the transition from rural to urban transit funding, GDOT needs to identify which counties are at risk for trending urban and experiencing a funding gap. In addition, to plan for funding allocations within the state, the department needs to know what the state's FTA § 5311 apportionment will likely be after 2020. If the percentage of rural population within the Nation decreases after the 2020 Census, there is a strong possibility that Georgia will receive less federal funding for rural public transit.

The primary objectives of this research are to: (1) Identify areas in Georgia that are trending urban (areas that are growing in population and will be reclassified from rural to urban in the 2020 Census); and, (2) Estimate how much federal funding the State of Georgia will receive for rural and small urban transit. This report will also document resources available to aid subrecipients that need to transition from a rural system to an urban system.

1.3 Technical Approach

This research will use urban and rural population data from the 2000 and 2010 Decennial Census (US Census Bureau 2015), population estimates from the 2015 5-year American Community Survey (US Census Bureau 2015), 2020 national population projections developed by the Weldon Cooper Center for Public Service (University of Virginia 2016), and 2021 populations produced by the Environmental Systems Research Institute (ESRI) population projections (ESRI 2017, Atlanta Regional Commission 2017) as base data for extrapolating the 2020 population at the block level. This projected population will be used to create a predictive model for urbanization in Georgia in 2020. The urbanization scenarios will be overlaid with 2015 transit funding and service data from the National Transit Database (NTD) (NTD 2016) to estimate which areas and counties might be required to transition federal transit funding sources.

1.4 Key Findings

The results from the scenario with the highest level of urbanization indicate that the percentage of Georgia's population living in urban areas could increase from 75 percent in 2010 to at most 82 percent by 2020. In the high urbanization scenario, under the assumption that urban areas will merge if their borders are touching, about 72 percent of Georgia's urban population will live in urbanized areas (areas with 200,000 or more people). This predicted level of urbanization could consequently cause seven counties in Georgia to switch from FTA § 5311 funding to FTA § 5307 large urban funding.

CHAPTER 2. LITERATURE REVIEW

This thesis studies how different demographic and land change models can be used to predict urban growth in Georgia. The first two sections of this chapter review existing methods for projecting populations and modeling urban growth. To model urbanization and predict the 2020 urban area boundaries it is important to understand what defines a rural and an urban area. The third section of this chapter documents the most commonly used definitions of urban and rural in the US. To study how an area's urban or rural classification can impact transit funding it is necessary to be familiar with the federal transit funding sources available to urban and rural areas. The last part of this chapter describes the primary differences between the FTA § 5311 and FTA § 5307 funding sources.

2.1 Demographic Models and Ratio Extrapolation

Many public and private organizations and academic institutions produce urban growth projections using either a variation of a cohort-component method or a structural model based on land-use and demographic data (Smith, Swanson, Tyman 2001, 2013).

The cohort-component method is used to project an area's population by age and sex (Smith et al. 2001, 2013). Although this method can be used to project any geography size, the majority of population projections are made for state or county geographies because of the availability of public data and estimates at those levels (ESRI 2017). The American Community Survey does not collect data for any geography smaller than a tract, which limits the ability to use the cohort-component method to project populations at a smaller geography, such as the block level.

To estimate the total population of a census block, ratio trend extrapolations methods can be used when the total population for the state, county, or census tract in the target year is known (Smith et al. 2001, 2013). This thesis uses the three commonly used ratio trend extrapolation methods (constant share, shift share, and share of growth) described in the book *State and Local Population Projections: Methodology and Analysis* by Smith, Swanson, and Tyman because 2020 (target year) population projections at the state level are publically available and this research is primary interested in estimating total population only. These "trend extrapolation methods are used much more frequently for total population projections than for projection population subgroups (e.g. race or ethnic groups)" (Smith et al. 2001, p. 162).

In the constant share method, the block population remains the same percentage of the larger geography's population in the projected year as the base year, thus grows at the same rate. The shift share method projects that growth rates for the small geography will change each year. Similarly, the share of growth method estimates the smaller area population will change, but it represents a percentage of the growth of the larger area's population growth (Smith et al. 2001, 2013). Equations 1-3 are taken directly from *State and Local Population Projections: Methodology and Analysis* and used in this research to extrapolate the block populations from the state and census tract population projections.

$$\text{Constant Share Method: } P_{it} = (P_{il} / P_{jl})(P_{jt}) \tag{1}$$

Shift Share Method: $P_{it} = (P_{jt})[(P_{il} / P_{jl}) + ((z/y)((P_{il} / P_{jl}) - (P_{ib} / P_{jb})))]$ (2)

Share of Growth Method: $P_{it} = P_{il} + [((P_{il} - P_{ib}) / (P_{jl} - P_{jb}))(P_{jt} - P_{jl})]$ (3)

"Where the smaller area is denoted by i; the parent area by j; z is the number of years in the projection horizon; y is the number of years in the base period; and b, l, and t refer to the base, launch, and target years, respectively" (Smith et al. 2001, 2013 p.176-180).

Since the ACS does not estimate the urban and rural population split for any geography, the methods discussed above can also be applied to population projections to estimate the urban population of an area. In this case the small population is the urban area and the large population remains as the state, county, or census tract. In addition to these methods, the United Nations' method for projecting urban and rural split requires small amounts of data and can also be used if the total future population is known (United Nations 1974). While the UN extrapolation method has change slightly since it was developed in 1970, "the basic approach has not changed" (UN 2014). Equation 4 is the original equation developed in 1970. Since 1970, the method for calculating the urban rural growth difference (d in equation 4) has changed. The method for estimating the urban rural growth difference has change because, "empirical evidence shows that the urban rural growth difference declines as the proportion urban increases" (UN 2014, p. 8).

United Nations' Method: $U_1 = ((T_1 + dR)/T)U.\ T_1 - U_1 = R'$ (4)

"Where T, U, and R are the total, urban, and rural population for the base year t, T_1, U_1, and R_1 are the total, urban, and rural populations for the projected year t+1, and d is equal to the difference between the urban and rural growth rates" (United Nations 1974 p. 38).

This study uses these ratio trend extrapolation methods to estimate the urban and rural split at the state level and the block population in 2020 from predeveloped population projections at the state and tract level.

2.2 Land Change Modeling

Although population growth is identified as the primary driving force of urbanization, many studies have found other variables, such as employment, land cover, and proximity to roads and city centers, to be a predictor of urban growth (Rui 2013). Structural models, such as logistic regressions, cellular-automata (CA), agent-based, fractal and neural network models are commonly used for modeling land change (Smith 2009, Rui 2013). Many studies have used open source models, like SLEUTH (a cellular-automata model), and land-change programs, like TerrSet Land-Change Modeler (a geospatial analysis software developed by Clark Labs), to estimate the transition from rural areas to urban area and analyze impact on biodiversity and land cover in and around cities (Programs like TerrSet perform logistic regressions by processing layers of raster files. These models can be used to project land change at a finite level, but they require extensive amounts of data. For example, the SLEUTH model uses slope, land use, exclusion, urban extent, transportation and hill shade data, which is collected from satellite imagery (Chaudhuri, Gargi & Clarke, Keith 2013). These models are primarily used to quantify environmental impacts of land change on bio-diversity, but some studies have recently adapted the model to predict urbanization.

A study looking at urbanization around the Atlanta Metropolitan Area, conducted by Zhiyong Hu and C.P. Lo, integrated other demographic variables such as employment, income, and race, and proximity variables such as distance to urban clusters, activity centers, and roads, into the land change model to gain a more comprehensive understanding of what factors influence urbanization (Hu, Lo 2006). This study uses the urban growth model developed by Zhiyong Hu and C.P. Lo as a base for developing a logistic regression model to predict urban area boundaries in 2020 because of the integration of land use and demographic data and the availability of data. However, this study uses SPSS to construct a logistic regression model instead of a raster based modeling software, like TerrSet.

2.3 Defining Urban and Rural Areas

It is difficult to make a clear-cut distinction between urban and rural areas. Knowing where to draw the line between urban cores, suburbs, and rural land is a complex task because urban and rural classifications are multidimensional concepts that can be based on land use patterns, economic influences, or even travel characteristics. In the US, "many people live in areas that are not clearly rural or urban (and) seemingly small changes in the way urban areas are defined can have large impacts on who and what are considered rural" (USDA ERS 2017). Although the two predominantly used definitions in the US broadly classify areas as either urban or rural, researchers and policy officials have developed multi-level definitions go beyond the black and white definition and that identify areas on a scale of urban. Depending on which definition is employed, the rural population of the US can range from 17 to 49 percent (USDA ERS 2017). The following section describes the two predominantly used definitions of urban and lists several other urban and rural classification schemes that are commonly used.

2.3.1 Urbanized Areas and Metropolitan Statistical Areas

The US federal government uses two main definitions of urban to classify a geographic region. One definition is produced by the US Census Bureau and the other by the Office of Management and Budget. In both cases, the rural territory, persons, and housing units are defined as any area that does not fit that urban definition (US Department of Commerce 2016).

The US Census Bureau uses total population thresholds, population densities, land uses, and distances as criteria for defining two types of urban areas: Urbanized Areas (UZA) and Urban Clusters (UC). A rural area is defined as any area outside of an Urbanized Area or an Urban Cluster boundary. An Urbanized Area is a region comprised of 50,000 people or more and an Urban Cluster is an area with at least 2,500, but no more than 50,000 people (US Census Bureau 2016). Both Urbanized Areas and Urban Clusters use blocks as the base geographical unit, but do "not follow city or county boundaries, and so it is sometimes difficult to determine whether a particular an area is considered urban or rural" (Federal Office of Rural Health Policy 2017). A Census block is classified as either urban or rural depending on its population density and proximity to other urban areas. In order for a block to be classified as urban, it must either have a population density of 1,000 people per square mile or be close to an urban core and have a population density of 500 people per square mile.

Because blocks are the geographical base for urban areas, census tracts and counties can be comprised of both urban and rural areas (US Census Bureau 2016a). A county is considered to be mostly urban if at least 89 percent of its population is urban (at most 11 percent rural) and mostly rural if at most 33 percent of its population is urban (at least 67 percent rural) (US Census Bureau 2015, 2016a).

The Office of Management and Budget defines a rural area as any area outside of a Metropolitan Statistical Area (MSA) (Health Resources and Service Administration 2017). A Metropolitan Statistical Area follows county boundaries and is based on the economic concept that labor market areas extend beyond the urban core. An MSA is comprised of multiple metro counties and contains a core area of 50,000 or more people (Bureau of Labor Service 2015, HRSA 2017). Although using counties as the geographical unit makes it easier to draw a line between urban and rural, a county is often too large to accurately represent the character of each subareas within its boundary (USDA ERS 2017). Rural counties outside of MSA boundaries are further classified as either Mircopolitan (Micro) or not. A county is considered Micro if it contains a core area of at least 10,000 people, but no more than 50,000 people (HRSA 2017, Federal Office of Rural Health Policy 2017).

Both the Census Bureau's and the Office of Management and Budgets definitions can be inaccurate when measuring rural populations and land area. The Census Bureau's definition overestimates the rural population by the exclusion of suburban areas in the urban population count. However, the definition provided by the Office of Management and Budget, which follows county boundaries, inevitably includes rural areas in Metropolitan Areas leading to an underestimation of the rural population. Because of the discrepancies between the definitions of urban and rural areas, the rural population in 2010 ranges from about 15 percent to 19 percent. Based on the US Census Bureau's definition, about 21 percent of the US population in 2000 (and 19.3 percent in 2010) was considered rural. In contrast, using the OMB definition, only 17 percent of the population was considered rural in 2000 (and 15 percent in 2010). Using the US Census Bureau's definition, one would observe no change in rural land area from 2000 to 2010. In both Decennial Census about 95 percent of the land area in the US was considered rural. In contrast, the OMB notes a 2 percent decrease in rural land area from 2000 to 2010 (from 74 percent in 2000 to 72 percent in 2010) (Federal Office of Rural Health Policy 2017).

2.3.2 Other Commonly Used Urban Rural Classification Schemes

The United States Department of Agriculture (USDA) Economic and Research Service (ERS) agency recognizes that there are instances when the broad rural classification does not accurately describe the socio-economic or land-use characteristics of a non-metro area. Consequently, the department developed several multi-level county classifications to measure the degree of rurality. The following list is compiled from the Overview of Rural Classifications USDA ERS website and provides an overview of each definition:

- <u>Rural-Urban Continuum Codes</u> classify all US counties into three metro and six non-metro categories based on population size and adjacency to a metropolitan area.
- <u>Urban-Influence Codes</u> subdivide the OMB metro and non-metro categories into a twelve-part classification scheme. The first two categories classify metro counties based on the population size of the metro area. Codes three through twelve classify non-metro counties based on the population size of the city or town within each county and adjacency to a metropolitan of mircopolitan area.

- Rural Urban Commuting Area Codes (RUCAs) classify all US Census tracts using measure of urbanization, population density, and commuting patterns . Tracts are classified on a scale of one to ten based on the size and direction of the primary commuting flows.
- County Typology Codes classify metro and nonmetro counties based on primary economic and social characteristics. The six economic characteristics are: farming, mining, manufacturing, federal/state government dependent, recreation, and nonspecialized. The seven social characteristics are: low education, low employment, persistent poverty, persistent child poverty, population loss, and retirement destination.
- Creative Class County Codes classify counties based on the share of the population that is employed as engineers, architects, artists, or people in other creative occupations. (USDA ERS 2016).

2.3.3 Combining Multiple Urban and Rural Definitions

The Federal Office of Rural Health Policy (FORHP) uses the Office of Management and Budget's definition and the US Department of Agriculture (USDA) and Economic Research's (ERS) Rural-Urban Commuting Area (RUCA) codes, which are based on US Census data, to define rural areas. The OMB definition of rural areas is used as a base to identify counties that are classified as rural. As mentioned above, OMB classifies all counties outside of an MSA boundary as rural. Because counties can cover large areas, a county that is classified as Metropolitan can sometimes contain areas that have rural characteristics. To overcome this misrepresentation, the FORHP uses RUCA codes to identify areas in within Metropolitan counties that are rural. RUCA codes four though ten to classify Census tracts inside metropolitan areas as rural. The FORHP identified 70,000 extremely large Census tracts where the use of RUCA codes failed to account for distance to services and sparse population. To account for this, "the FORHP designated 132 large Census tracts (Census tracts with a land are of at least 400 square miles and a population density of no more than 35 people) with RUCA codes of 2 or 3 as rural" (HRSA 2017). Based on the FORHP analysis, about 18% of the population and 84% of the land area were classified as rural in 2010 (HRSA 2017). This hybrid urban and rural classification scheme results in a rural population size that falls between the portion identified using the Census Bureau's and OBM's definitions. As previously mentioned, using the US Census Bureau's definition of urban, about 19.3 percent of the US population in 2010 was considered rural, and using the OMB definition about 15 percent of the US population was considered rural (FORHP 2017).

2.4 Urban and Rural Transit Funding

The Federal Transit Administration (FTA) administers federal transit funding to state departments, local governments, and transit agencies through competitive grants and formula grants. As of 2015, the FTA managed 14 competitive grant programs and 13 formula grant programs. All of the grants are supported by the Fixing America's Surface Transportation Act (FAST Act), which guarantees funding for public transit through 2020 (FTA 2017).

2.4.1 FTA § 5307 and FTA § 5311 Formula Grants

The largest amount of consistent annual funding for public transit in the US is provided by the FTA § 5307 and 5311 Formula Grants. Although both programs support public transit, they are designed differently to ensure that the needs of populations in urban and rural areas are met equitably. The FTA § 5307 Formula Grants provide funding for public transit in urban areas with populations of 50,000 or more. Rural areas with population of 50,000 or less are eligible for the FTA § 5311 Formula Grants (FTA 2015). For the most part, the FTA uses the Census Bureau's definitions of urban areas to determine an area's eligibility for FTA § 5307 and 5311 Formula Grants. However, the FTA considerers Urban Clusters (areas with 2,500 – 50,000 people) as rural and urban areas (areas with populations of 50,000 or more) are split into two categories: small urban and large urban. The FTA defines small urban areas as areas with a population between 50,000 and 200,000 people and operating less than 30 vehicles. Large urban areas have a population of 200,000 or more and/or operate over 30 vehicles or a fixed guideway system, such as a train. In summary, using the US Census Bureau's definitions, rural areas and Urban Clusters (UC) are eligible for FTA § 5311 Formula Grants and Urbanized Areas (UA) are eligible for FTA § 5307 Formula Grants (FTA 2017).

In addition to area eligibility differences, the regulatory requirements between the two programs differ based on who can be the direct recipient, the percentage of local matching funds required for operating expenses, what the grants can be used for, and how sub-recipients report back to FTA. Table 1 provides a summary of the primary differences between the two programs and the subsequent sections detail specific differences (FTA 2017).

Table 1. Differences between Rural, Small Urban, and Large Urban Transit Systems. Data Source: NTD 2017

	Rural	Small Urban	Large Urban
Definition	Population less than 50,000	Population between 50,000 – 200,000	Population over 200,000
FTA Formula Grant	FTA § 5311	FTA § 5307	FTA § 5307
Primary Grant Recipient	Governor or State DOT	Governor or Governor Designee	Transit Agency
Federal Match for Operating Costs	50% for operating costs	50% for operating costs	No funding for operating costs
FY2017 Reporting Requirements	Annual NTD report consisting of 4 forms	Annual NTD report consisting of 6 forms	Monthly transit service report, monthly safety and security report, and an annual NTD report consisting of 14 forms

2.4.2 Direct Recipients and Sub-recipients

As previously mentioned, the FTA splits urban areas into two categories: (1) small urban, which is an area with a population between 50,000 to 200,000; and (2) large urban, which is defined as an area with more than 200,000 people. State governors or governor designees are responsible for distributing FTA § 5307 funding to small urban areas, whereas large urban areas can apply directly to FTA for 5307 transit funding.

For rural areas, governors of each state designate a qualified state agency as the recipient of FTA § 5311 Formula Grants. The designated state agency is then responsible for distributing to sub-recipients (local governments, regional planning organizations, or transit agencies) within the state. State agencies are allowed to use up to 10% of their FTA § 5311 Grant for administration and technical assistance costs (FTA 2015).

2.4.3 State Apportionments

The portion of FTA § 5307 funds that each state receives is based on the state's urban population, urban population density, low-income population, and vehicle revenue miles (FTA 2017). Similarly, states receive a portion of the FTA § 5311 funds based on the state's "rural population, the number of low-income people living in rural areas, and vehicle revenue miles" (FTA 2017). However, the FTA § 5311 formula also incorporates amount of rural land within a state. Figures 1 and 2 are taken directly from the FTA apportionment website titled FAST ACT Formula Flow Charts and depict the breakdown of the FTA § 5307 and 5311 formulas, respectively, in the form of a flowchart and include the weight of each variable. The 2010 Census data (population, population density, land area) and the ACS 5-year data on low-income individuals were used to determine each state's apportionment since FY2013 and will continue to be used until the release of the 2020 Decennial Census (FTA 2017). The FTA calculates "the non-urbanized population and non-urbanized land area by subtracting the urbanized population and land area from the state's total population and land area" (FTA 2015, p. 4).

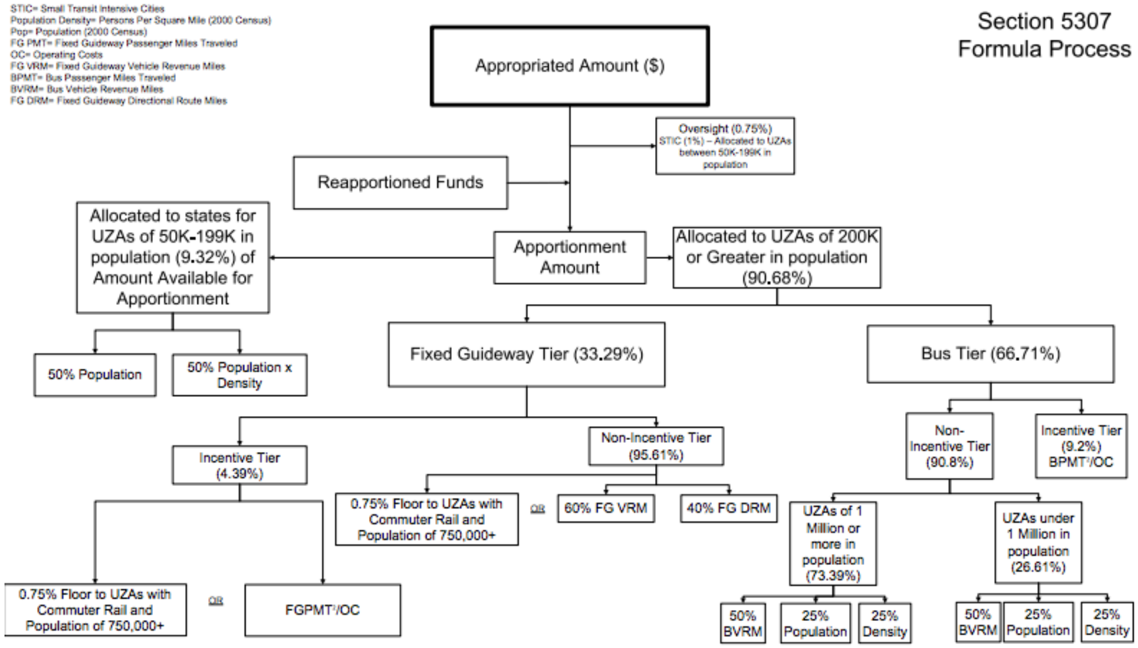


Figure 1. FTA § 5307 Apportionment Flow Chart. Data Source: Taken directly from 5307 Urbanized Area Formula Program Apportionment PDF.

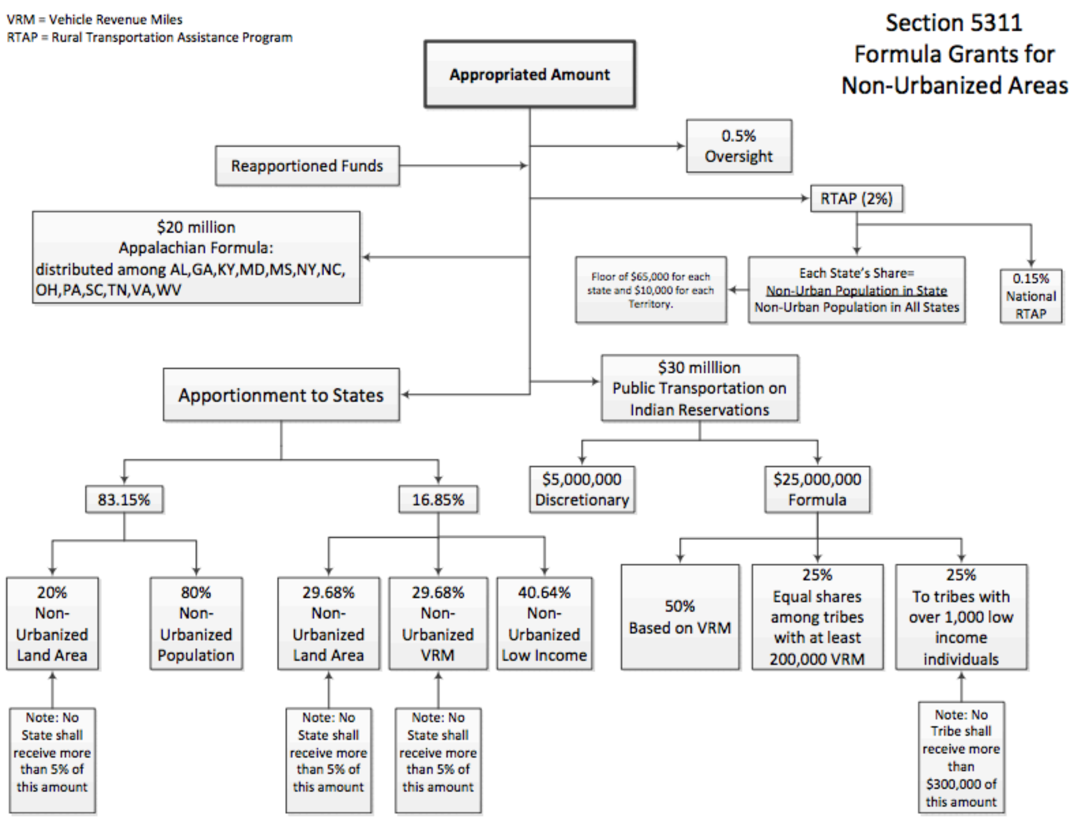


Figure 2. FTA 5311 § Apportionment Flow Chart. Data Source: Taken directly from 531 Urbanized Area Formula Program Apportionment PDF.

2.4.4 Local Match Requirements

For FTA § 5307 Formula Grants for Urban Areas the federal share is not to exceed:

- 90 percent for the cost of vehicle-related equipment
- 90 percent of the project cost for projects related to bicycles
- 80 percent of the net project cost for capital expenditures
- 50 percent of the net project cost of operating assistance (FTA 2015).

For FTA § 5311 Formula Grants for Rural Areas the federal share is not to exceed:

- 80 percent of the net project cost for capital expenditures

- 80 percent of the cost for American with Disabilities non-fixed route Paratransit
- 50 percent of the net project cost of operating assistance (FTA 2015).

2.4.5 Eligible Activities

Large urban and small urban areas can use FTA § 5307 Formula Grants for transit planning and capital expenditures. Capital expenses can include purchasing, leasing, constructing, or repairing rolling stock (buses, trains, etc.) and transit facilities (stations, stops, tracks, etc.), whereas routine maintenance, and employee salaries are considered operational expenses. Only small urban areas can use FTA § 5307 Formula Grants to fund up to 50% of operating assistance (FTA 2015).

Transit providers in rural areas can use FTA § 5311 Formula Grants for transit "planning, capital and operating expenditures, job access and reverse commute projects, and the acquisition of public transit services" (FTA 2015). Job access and reverse commute projects are transit service projects that transport welfare recipients and low-income populations to and from jobs in suburban locations (Pudget Sound Regional Commission 2017). The acquisition of public transit service is when a local jurisdiction hires a private transit company to provide public transit service.

2.4.6 Reporting Requirements

Although each FTA grant recipient is required to submit an annual report to the National Transit Database (NTD), the level of detail and information required varies for transit agencies operating large urban systems, small urban systems, and rural systems.

Reporting requirements for each type of system are outlined in the annual NTD policy manual. The FTA refers to large urban systems (population 200,000 or more and/or operating more than 30 vehicles or a fixed guideway system) as “Full Reporters”, which indicates that they report the most amount information of any type of system. Full Reporters submit monthly reports detailing their “vehicle revenue miles, vehicle revenue hours, unlinked passenger trips, and vehicles operated in maximum service” (NTD 2017), monthly Safety and Security reports, and an annual NTD report that includes 14 forms outlining financial and service information, such as maintenance performance, fuel consumption, and employee counts and hours. Small urban systems (urban areas with 50,000 to 200,00 people operating 30 vehicles or less and no fixed guideway system) are referred to by FTA as “Reduced Reporters” or “Small System Reporters” and have significantly less reporting requirements than large urban systems. Small urban systems submit the same annual report package (four basic inventory forms) as rural areas plus two additional forms (FFA-10 Federal Funding Allocation Statistics and D-10 CEO Certification). In addition to the two additional forms, small urban systems are required to report more detailed information on the B-10, A-10, and A-30 forms. For example, on the A-30 form Small System Reporters are required to report manufacturer, model, fuel type, and standing capacity as well as miles this year and average lifetime miles for each fleet, in addition to the basic information such as vehicle type, length, and manufacturer. Table 2 lists all of the forms in the NTD annual report package and calls out which forms are required for each type of system (NTD Communications 2017). Note that as of FY18, additional forms must be submitted by all subrecipients to meet new transit asset management (TAM) requirements.

Table 2. NTD Reporting Requirements (NTD 2015)

NTD Report Package Form	Large Urban Systems	Small Urban Systems	Rural Systems
B-10 Identification Form	X	X	X
A-10 Station and Maintenance Facilities (one per mode)	X	X	X
A-20 (Fixed Guideway) Transit Way Mileage	X		
A-30 Revenue Vehicle Inventory (one per mode)	X	X	X
F-10 Sources of Funds – Funds Expended and Funds Earned	X		
F-20 Use of Capital	X		
F-30 Operating Expenses (one per mode)	X		
F-40 Operating Expenses Summary	X		
F-60 Financial Statement	X		
R-10 Employees (one per mode)	X		
R-20 Maintenance Performance	X		
RR-20 Reduced Reporting Form		X	X
S-10 Service (one per mode)	X		
FFA-10 Federal Funding Allocation Statistics	X	X	
D-10 CEO Certification	X	X	

2.4.7 Transitioning between FTA § 5307 and 5311 Funding Sources

An area's share of 5307 transit funding is directly related to its population growth. If an area remains in the same population bracket, but experiences a larger population increase relative to other areas within the same population bracket, it will see an increase in transit funding. For example, if a small urban area within the 50,000 – 200,000 population bracket experiences an increase in population, but does not exceed the 200,000-person threshold, that area's share of FTA § 5307 funding will increase. However, if an area exceeds a population threshold and transitions to the next funding tier, it is at risk for experiencing a decrease in transit funding. This is because "the amount of funds available to urbanized areas over 1 million is greater than the amount available to urbanized areas in the between 200,000 and 1 million-tier, [yet] the percentage of the funds that go to [a new urbanized area] in the over 1 million-tier is less than their percentage in the prior tier" (NTD 2015). Thus, if an area exceeds the 1 million-person threshold and transitions into the next funding tier, it will experience a decrease in funding because it is now competing with other urbanized areas that have greater populations and densities. This situation can also apply to rural areas transitioning to small urban areas and small urban areas transitioning into large urban areas, but in these cases the amount of recorded transit data such as vehicle revenue miles may also be a factor that determines the allotted amount. In summary, an area could experience a decrease in transit funding if its population growth is small relative to other areas in the same funding tier or if it transitions between funding tiers. FTA's recommendations for areas transitioning to urban areas or becoming a part of an urban area are listed in Figures 3 -5.

New Urbanized Areas

In the case of the areas that became new urbanized areas over 50,000 but under 199,999:

- Transit providers in the new Small UZA will need to become knowledgeable of, and fully participate in, the planning activities of a newly designated metropolitan planning organization (MPO) for that UZA.

- Transit providers that are eligible public entities may elect to become a direct recipient and receive grants directly from FTA. Direct recipients are subject to oversight by FTA, which includes additional reporting requirements and compliance reviews (e.g. civil rights reviews, triennial reviews.)

- Private, non-profit organizations that provide public transit services in urbanized areas will need to be under contract with an eligible direct recipient in order to receive funds.

- Funding for Small UZAs will be apportioned to the Governor as the Designated Recipient responsible for allocating these funds to the various small UZAs in the State. Amounts specific to each small UZA are published by FTA for informational purposes only, and are nonbinding on the Governor.

- For multi-state Small UZAs, the Governor's Apportionment will include an amount attributable to the state's share of the Small UZA's population.

- Transit providers in the formerly non-urbanized area will now be eligible to receive funds under the FTA's formula programs for urbanized areas.

Figure 3. FTA Recommendations for Rural to Small Urban Transitions.

Data Source: Taken directly from FTA's Census 2010 and FTA Formula Grants Report page six (FTA 2015).

New Large Urbanized Areas

In the case of urbanized areas that have grown over 200,000 in population:

- The Governor must select an appropriate agency as the Designated Recipient, which will be responsible for sub-allocating FTA program funding to other service providers in the Large UZA.

- Current direct recipients of FTA funding will no longer be eligible for reimbursement of operating expenses, such as fuel and operator salaries, for services in a large UZA. An exception exists for transit service providers that operate fewer than 100 buses in fixed route service during peak hours.

- Transit providers in Small UZAs that have grown to above 200,000 in population will need to become knowledgeable of, and fully participate in, the planning activities of their MPOs, as a more robust level of multimodal planning is involved.

Figure 4. FTA Recommendations for Rural to Small Urban Transitions.

Data Source: Taken directly from FTA's Census 2010 and FTA Formula Grants Report pages six – seven (FTA 2015).

Formerly non-Urbanized Areas

In the case of formerly non-urbanized areas that have been subsumed into an urbanized area:

- Transit providers in the formerly rural area that are eligible public entities may elect to become a Direct Recipient and receive grants directly from FTA as allocated by the Designated Recipient. Direct recipients are subject to oversight by FTA, which includes additional reporting requirements and compliance reviews (e.g. civil rights reviews, triennial reviews).

- Private non-profit organizations that provide public transit in the formerly rural area will need to cooperate with an eligible Direct Recipient in order receive funds.

- The MPO for the UZA and transit providers in the formerly non-urbanized area will be required to coordinate in the programming of Federal transit funding (in cooperation with the Designated Recipient in areas with populations of 200,000 or more).

- If the formerly non-urbanized area has become part of a Large UZA, the state and designated recipient(s) must submit documentation that any transit providers in the formerly non-urbanized area have concurred in the selection of the designated recipient.

Figure 5. FTA Recommendations for Rural to Small Urban Transitions.

Data Source: Taken directly from FTA's Census 2010 and FTA Formula Grants Report page seven (FTA 2015).

2.5 Summary of Literature Review

Urbanization can be modeled at two levels. The first level is a broad statewide assessment. Ratio extrapolation methods can be used to estimate the future urban and rural split at the state level from predeveloped population projections. The second level of analysis can be done at the Census block level to predict changes in urban area boundaries. From this more detailed model, the percent of a county's population living in an urbanized area can be estimated.

The degree of urbanization at the county level can be estimated from the percentage of that counties population living in an urbanized area. The US Census classifies a county as mostly urban if at least 89 percent are living in urban areas. A county’s predicted degree of urbanization can be used to speculate its transit funding eligibility in 2020. The following chapters review the methods used for predicting urbanization at the broad state level and the detailed block level.

CHAPTER 3. STATEWIDE URBANIZATION

3.1 Population Data

The 2010 Decennial Census data is the most current urban and rural population data available. The 2015 ACS estimates total population, but not the urban and rural split. To predict broad urbanization trends at the state, this study uses 2000 and 2010 US Census Bureau urban and rural population counts, 2015 total population estimates, and 2020 and 2021 population projections to predict statewide urban and rural splits in 2020. This study uses 2020 population projections from the University of Virginia's Weldon Cooper Center for Public Service and ESRI. Both data sources use different methods for projecting the 2020 populations.

The University of Virginia's Weldon Center for Public Service develops National and State population projections for 2020, 2030, and 2040 using the Exponential Growth Method and Hamilton-Perry Method (Weldon Cooper Center 2017). The 2020 total population for each state is projected by calculating the population growth rate between 2010 and 2015 for each state using US Census Bureau data. This formula can be seen in Figure 6. The growth rate is then applied it to the exponential growth formula (Figure 7), which uses 2015 as the launch year.

$$StatePopulation_{2015} = StatePopulation_{2010} * e^{r*5.25}$$

which implies the rate is

$$r = \frac{1}{5.25} * \ln\left(\frac{StatePopulation_{2015}}{StatePopulation_{2010}}\right)$$

Figure 6. Weldon Cooper Center for Public Service Growth Rate Formula.

Data Source: University of Virginia The Demographic Research Group State and National Projections Methodology Paper page 1.

$$StatePopulationExp_{2020} = StatePopulation_{2015} * e^{r*4.75}$$

This is the final state level population projection for 2020,

$$\boldsymbol{StatePopulation_{2020}} = StatePopulationExp_{2020}$$

Figure 7. Weldon Cooper Center for Public Service Exponential Growth Formula.

Data Source: University of Virginia The Demographic Research Group State and National Projections Methodology Paper page 2.

ESRI develops 2017 through 2022 demographic forecasts for counties and block groups across the US. The Atlanta Regional Commission purchased these data for the entire state of Georgia and shared the 2021 Census tract population projections for this research. The 2021 total tract populations are derived by aggregating the 2021 block group population estimates. Block group population change is modeled via the cohort-survival method using data from Experinan, the US Postal Service, and Metrostudy (ESRI 2017).

3.2 Projection Methods

Predeveloped population projections for 2020 are at the State and Census Tract geographies. The 2020 urban and rural population are estimated from the 2020 and 2021 population projections by using the constant share, shift share, share of growth, United Nations' methods, taking the average of four methods, and by summing the population of every urban block in the modeled scenarios. The 2000 and 2010 Census data are used as the base and launch year for projecting the 2015 urban and rural populations. These 2015 projected populations are then used as the launch year (and 2010 as the base year) for projecting the 2020 urban and rural populations. A 2020 urban and rural population for each state is produced from each extrapolation method, the average of all methods, and the average of the shift share and share of growth method. The projections are performed using both the 2020 state population projections from the Cooper Center and the 2021 Census tract population projections from ESRI, and the results are compared.

3.3 Current Trends

3.3.1 Urbanization Across the Nation

Over half of the world's population resides in urban areas. The United Nations reported that as of 2014, "54 percent of the world's population (lived) in urban areas, a proportion that is expected to increase to 66 percent by 2050" (UN 2014). Figure 8 is from the UN World Urbanization Prospects 2014 Report and illustrates the change in the world's urban and rural populations from 1950 to 2050. Nearly 20 percent of the world's urban population lives in "medium-sized" cities (cities with one to five million people) and close to half live in areas with less than 500,000 people. Although the percentage of people living in "medium-sized" cities is expected to increase by 34 percent over the next 15 years, the percentage of people living in small cities and towns (areas with less than 500,000 people) is projected to decrease to 45 percent by 2030 (UN 2014).

In 2014, North America had the highest level of urbanization in the world with 81.5 percent of its population living in urban areas (UN 2014). The US follows a similar urbanization trend and as of 2010, 80 percent of its population was urban. Within the US, the South and West regions grew the fastest between 2000 and 2010 (Census 2011). Figure 9 illustrates the percent change in population between 2000 and 2010 for each state in the continental US. If population growth in that decade is mapped at a smaller geography, such as a county, it becomes apparent that population growth is not evenly distributed across the state, but rather concentrated in and around urban areas, as seen in Figure 10. The US urban population increased by 12 percent between 2000 and 2010 and the number of urbanized areas (areas with more than 50,000 people) in the US increased from 452 to 497 (Census 2011). In accordance with this urban population growth, the amount of urban land (land inside an urban area) expanded from about 60 million acres in 2002 to around 70 million acres in 2012 (ERS, Census Bureau 2014). However, the number of urban clusters (areas with population from 2,500 to 5,000 people) decreased from 3,158 to 3,095 in the same decade (Census 2011).

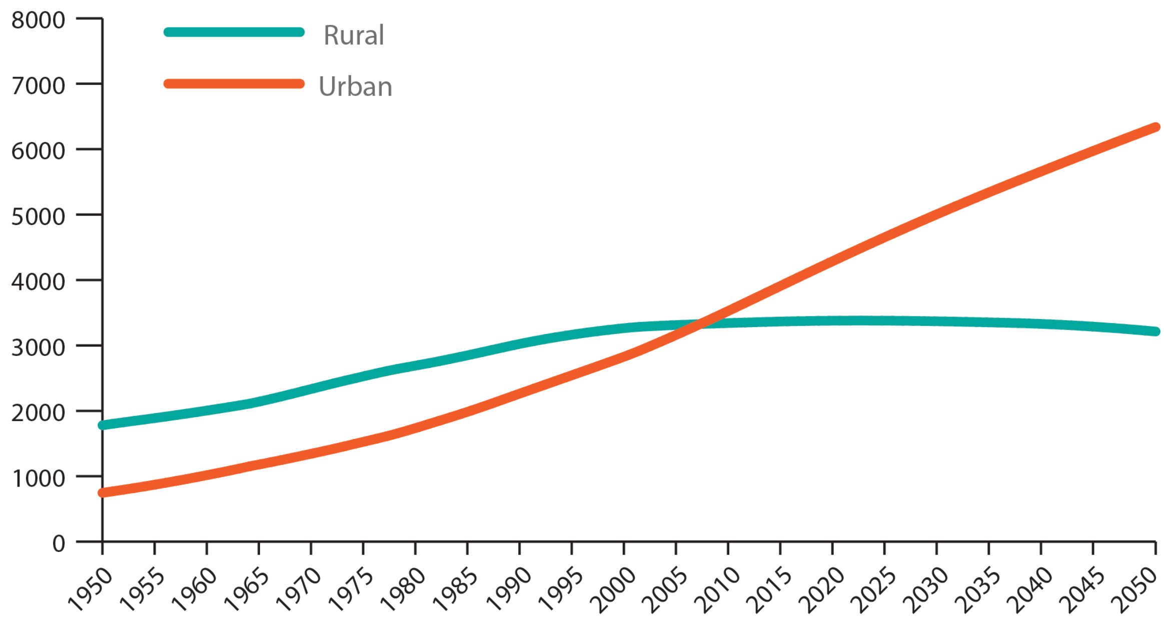


Figure 8 United Nations 2014 World Urbanization Prospects [Highlights] page 7: Urban and Rural Population of the World, 1950 – 2050. The number of people living in urban areas exceeded the rural population in 2007. The UN projects a constant increase in the world's urban population, but expects the rural population to reach its peak around 2020.

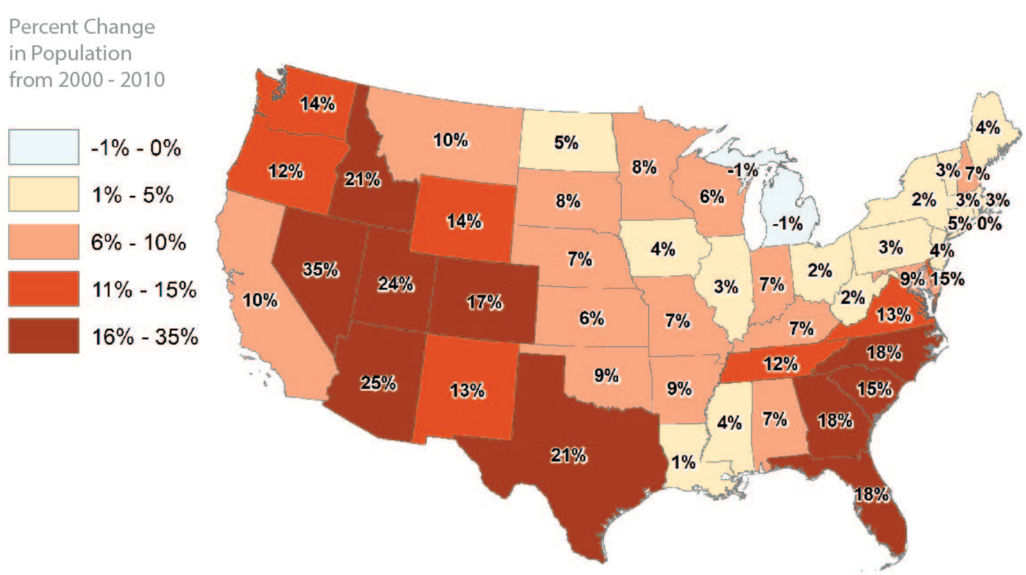


Figure 9. Percent Change in Population from 2000 to 2010 at the State Level Across the US. from 2000 to 2010. The south and west regions of the US grew the fastest. The

South grew by 14.3 percent over the decade bringing the total population of that region to 114.6 million people and the West's population increased by 13.8 percent and reached a population of 71.9 million people. Data Source: US Census Bureau 2015.

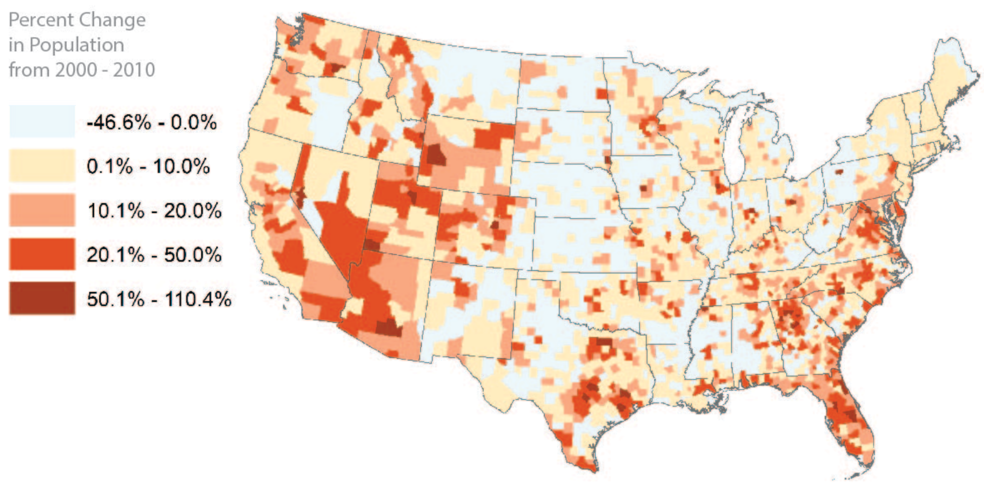


Figure 10. Percent Change in Population from 2000 to 2010 at the County Level Across the US. Mapping population change at a finer grain, such as a county level, reveals that growth is not evenly distributed across the state and that it is actually concentrated around cities. Data Source: US Census Bureau 2015.

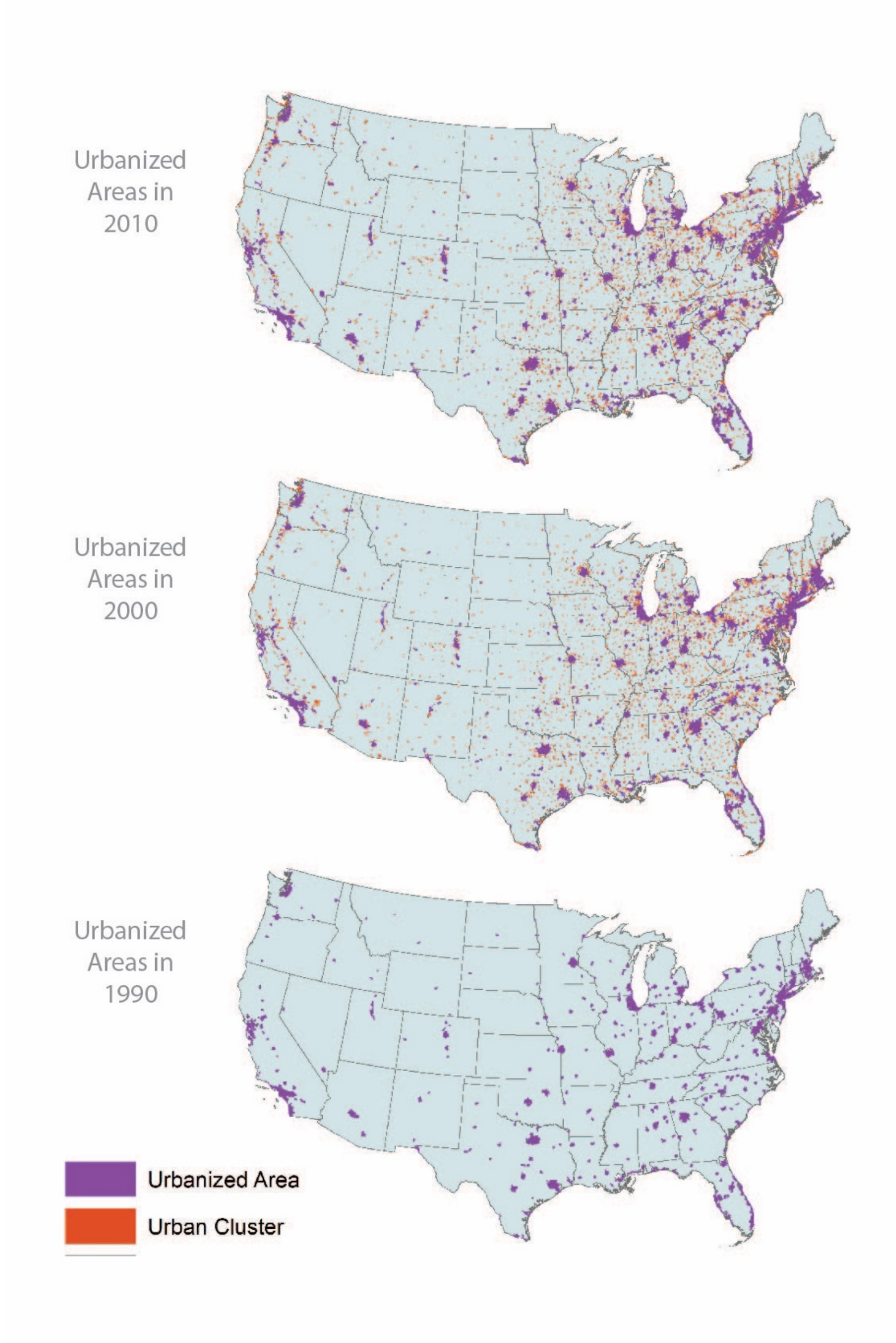


Figure 11. Urban Areas in the US from 1990 To 2010. The US Census created an additional sub-classification of urban areas in 2000, which is why urban clusters appear on the 2000 and 2010 map, but not the 1990 map. Data Source: US Census Bureau 2010.

3.3.2 Urbanization in Georgia

Georgia is in the top ten fastest urbanizing states in the US. Between 2000 and 2010 Georgia's population increased by 18.3 percent, bring the population to over 9.6 million (Census 2011). The majority of that growth occurred in and around urban areas. Between 2000 and 2010 Georgia had the 7th highest percent change in its urban population and 10th highest between 2010 and 2015. Over the past decade, Georgia's urban population increased by 24% percent whereas the rural population only increased by 4% percent. Figure 12 depicts the change in the urban and rural population split within Georgia from 1990 to 2010. Figures 13 and 14 display the percent change in each state's urban population between 2000 and 2010 and 2010 and 2015, respectively.

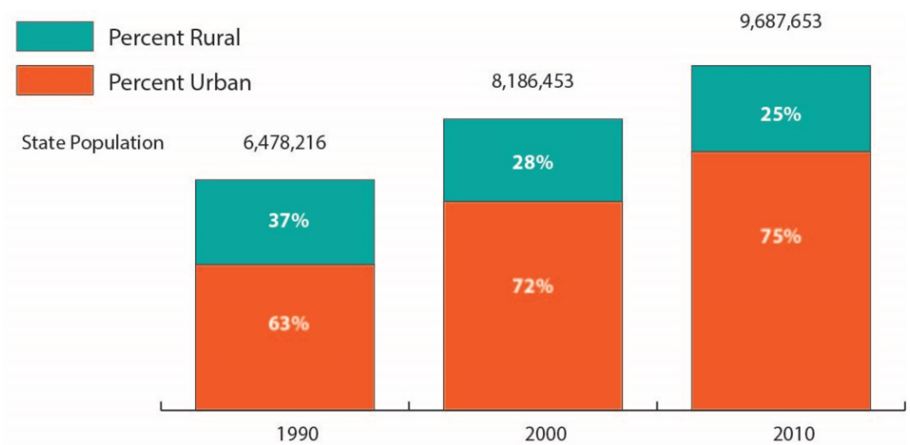


Figure 12. Georgia's Urban and Rural Population Split from 1990 to 2010. Data Source: US Census Bureau 2010.

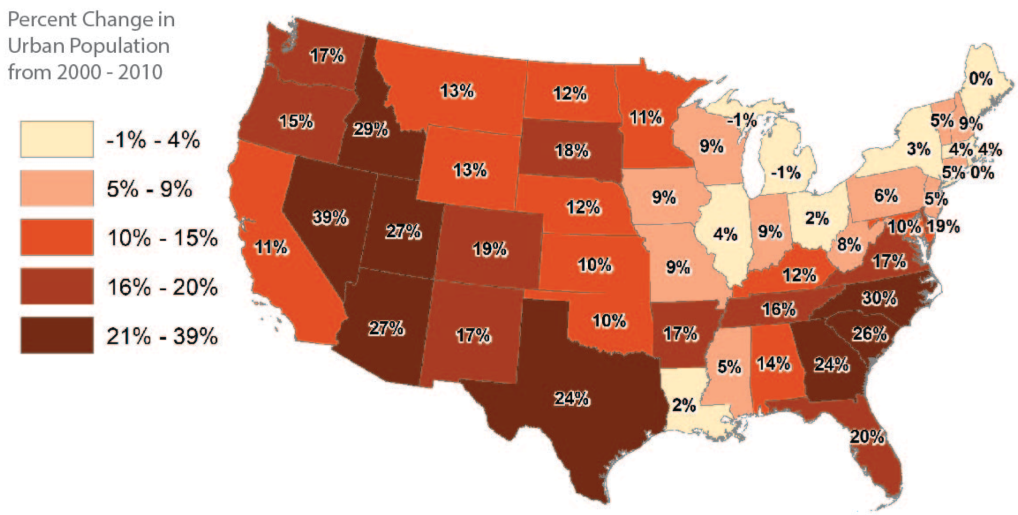


Figure 13 Percent Change in Urban Population from 2000 to 2010. The percent change in urban population follows a similar trend as the overall population. The South and West regions of the US experienced the highest percent change in urban population. Data Source: US Census Bureau 2010.

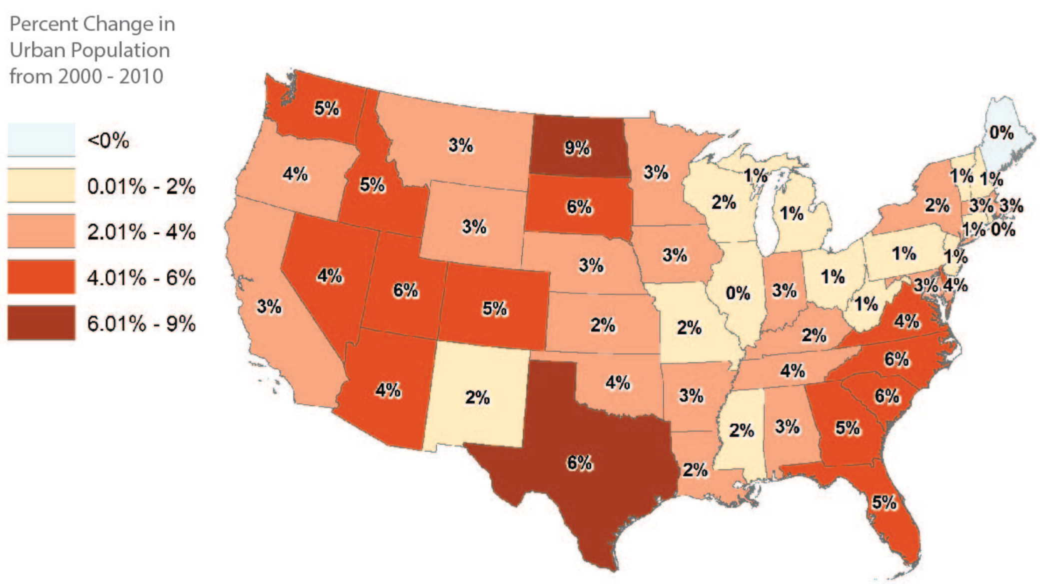


Figure 14. Percent Change in Urban Population from 2010 to 2015. North Dakota experienced the highest percent change in urban population between 2010 and 2015 followed by Texas. Data Source: US Census Bureau 2015.

Within Georgia, Forsyth, Paulding, Henry, Newton, Cherokee, and Barrow Counties saw a population growth of more than 50 percent between 2000 and 2010. These six counties border the core of the Atlanta Metro Region. Counties on the southeastern edge of the state that are near the City of Savannah, counties south of Atlanta close to the City of Macon, and counties around the City of Valdosta experienced growth comparable to that of counties around the Atlanta Metro Region. Figures 15 and 16 depict the change in population at the county and Census tract, respectively. Although Forsyth County and Cherokee County remain among the fastest growing counties between 2010 and 2015, the population growth slightly shifts from counties bordering the core to counties in the central core of the Metro area. Again, looking at the percent change in population at a finer grain, such as the Census tract level, it becomes more apparent that population growth is occurring in and around large urbanized areas.

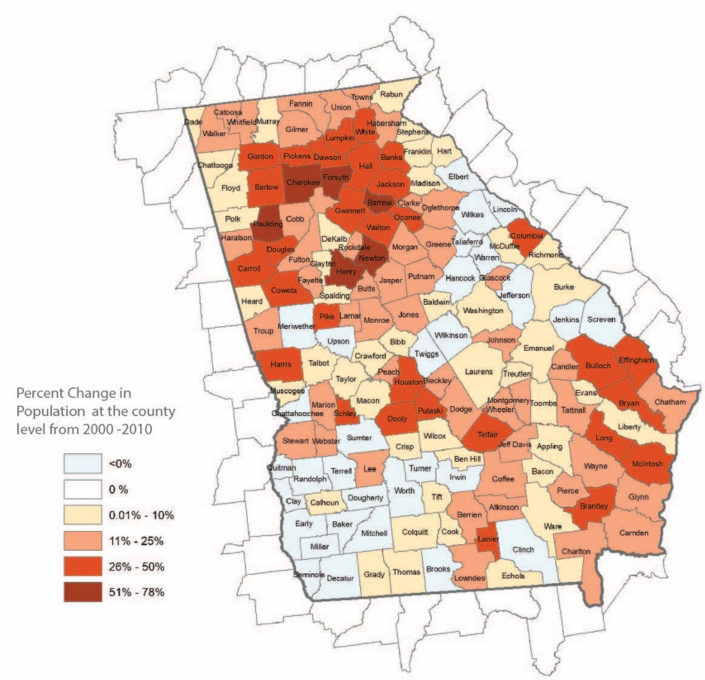


Figure 15. Percent Change in Population at the County Level from 2000 to 2010. Data Source: US Census Bureau 2015.

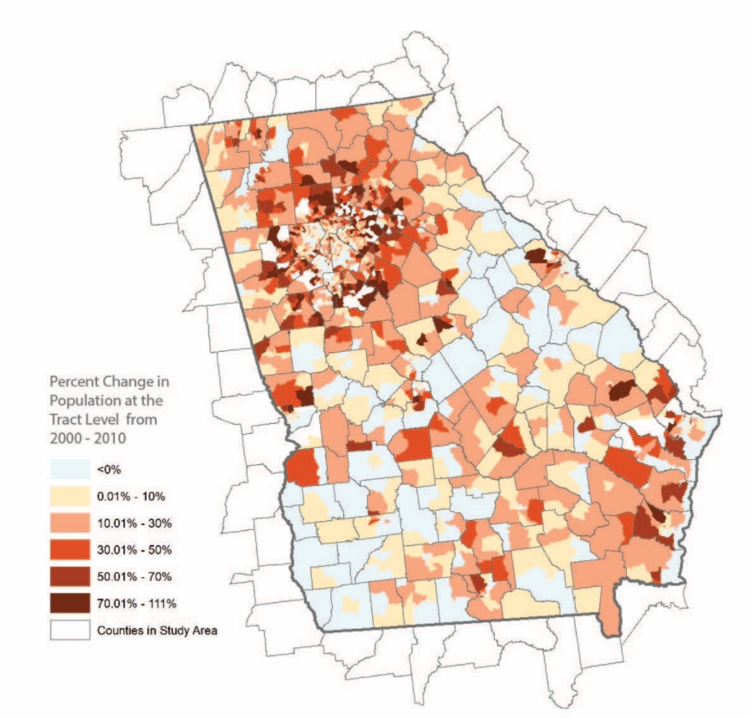


Figure 16. Percent Change in Population at the Census Tract Level from 2000 to 2010. Data Source: US Census Bureau 2015.

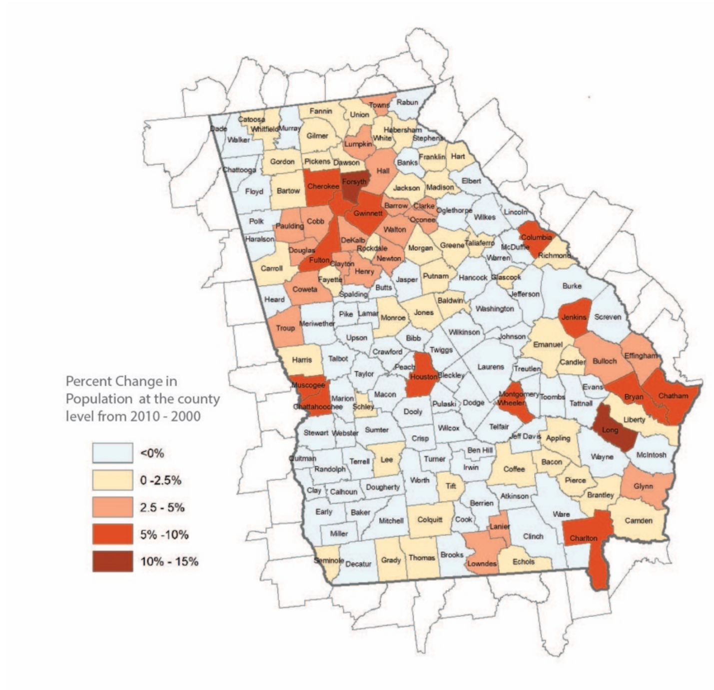


Figure 17. Percent Change in Population at the County Level from 2010 to 2015. Data Source: US Census Bureau 2015.

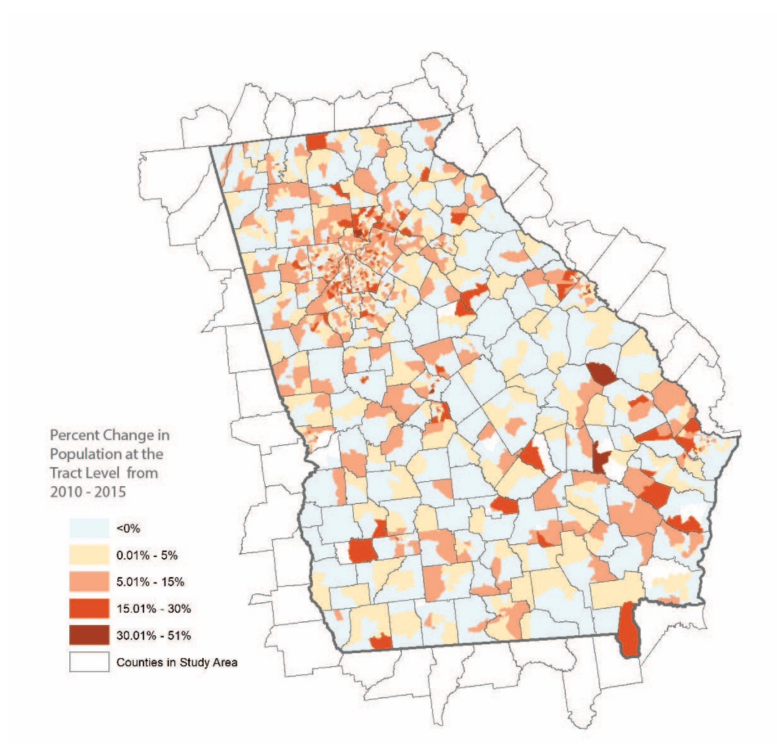


Figure 18. Percent Change in Population at he Census Tract Level from 2010 to 2015. Data Source: US Census Bureau 2015.

In 2010, 75 percent of Georgia's population lived in urban areas. Of that 75 percent, 81 percent live in large urbanized areas (areas with a population greater than 50,000). Between 2000 and 2010, the number of urbanized areas in Georgia increased by one, but the amount of urban land nearly doubled (3,770 square miles in 2000 and 5,268 square miles in 2010). This is an indicator that population growth is occurring in and around urban area. Once a rural area on the border of an urban area reaches a population density of 500 people per square mile, it merges into the adjacent urban area (US Census 2000). Figure 19 illustrates the outward expansion of urban areas and Table 3 details the population growth of urbanized areas in Georgia.

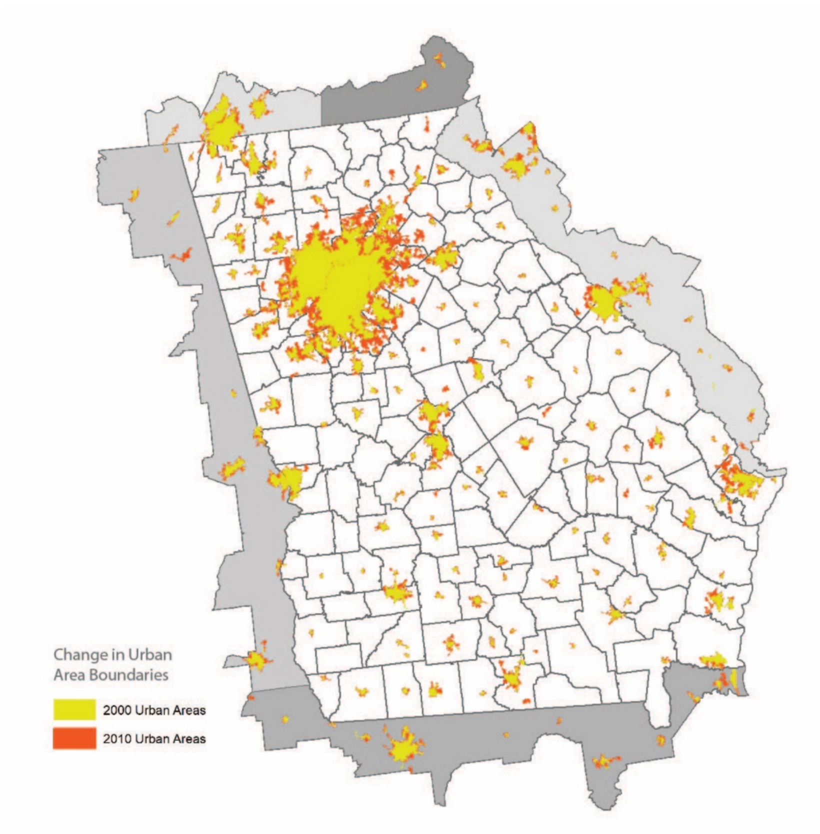


Figure 19. Urban Areas in Georgia in 2000 and 2010. The 2000 urban areas are overlaid on the 2010 urban areas to illustrate the changes within the decade and highlight expansion outward. Data Source: US Census Bureau 2015.

Table 3. Urbanized Areas in Georgia in 2000 and 2010

Urban Area	2000 Population	2010 Population	Population Change	Percent Change
Atlanta, GA	3,499,840	4,515,419	1,015,579	29.0%
Savannah, GA	208,886	260,677	51,791	24.8%
Columbus, GA-AL	242,324	253,602	11,278	4.7%
Macon, GA	135,170	137,570	2,400	1.8%
Warner Robins, GA	90,838	133,109	42,271	46.5%
Gainesville, GA	88,680	130,846	42,166	47.5%
Albany, GA	95,450	95,779	329	0.3%
Dalton, GA	57,666	85,239	27,573	47.8%
Valdosta, GA	57,647	77,085	19,438	33.7%
Rome, GA	58,287	60,851	2,564	4.4%
Hinesville, GA	50,360	51,456	1,096	2.2%
Brunswick, GA	51,653	51,024	-629	-1.2%
Cartersville, GA*		52,477		

*New Urbanized Area in 2010

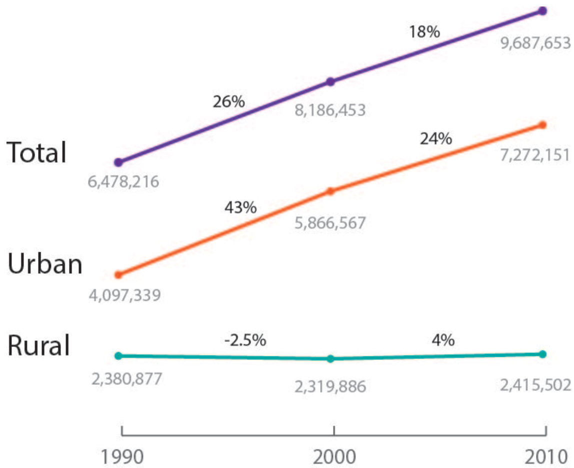


Figure 20. Urban and Rural Population Growth in Georgia from 1990 to 2010. The intent of this graph is to show that the growth rate difference between the rural and the urban population in Georgia. However, it is difficult to compare the 1990 urban rural population split to the 2000 and 2010 data because the definition of urban changed over that time period. This might explain the decrease in rural population between 1990 and 2000 and then the increase between 2000 and 2010.

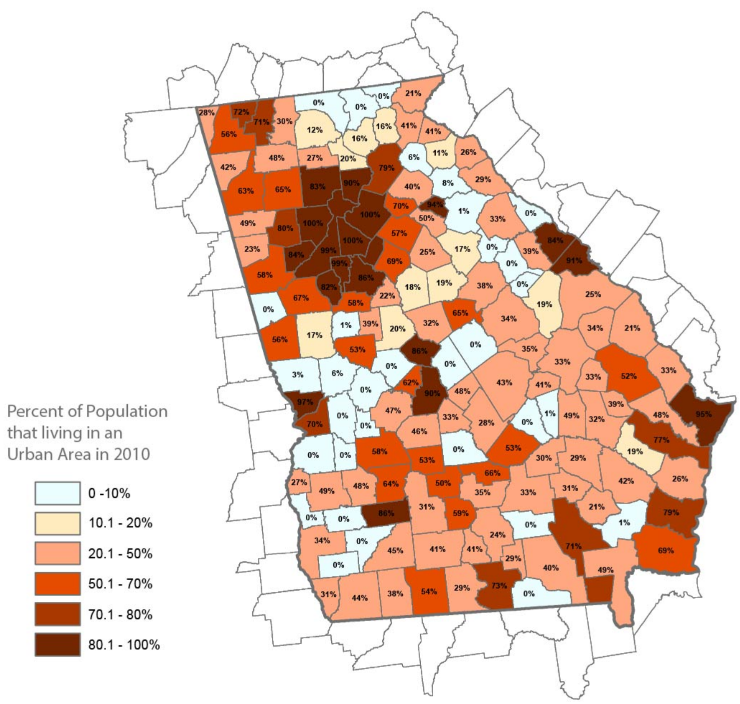


Figure 21 Percent of Population Living in an Urban Area in 2010. Counties that experienced the fastest growth between 2000 and 2010 are also the counties with the

highest percent of people living in an urban area. The majority of these counties are clustered in the core of the Atlanta Metro Region.

3.4 Projections

Across each scenario Georgia is projected to have the 9th largest urban population in the United States. The results of the urban and rural population projections at the state level estimate Georgia could be between 76 and 78 percent urban in 2020. Figure 22 compares Georgia's population growth to that of the Nation.

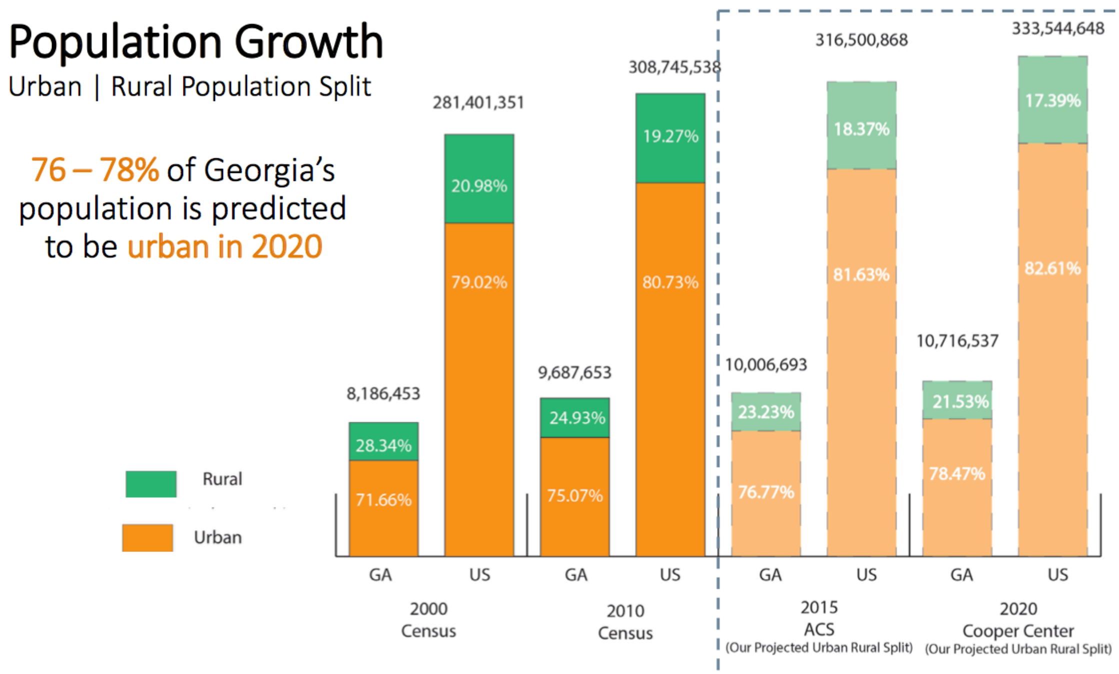


Figure 22. Urban and Rural Population Projections for Georgia and the US. Data Source: US Census Bureau 2000 and 2010 Decennial Census, 2015 ACS, and 2020 Weldon Cooper Center for Public Service.

Even though Georgia is within the top 10 most urban states, it is predicted to continue to be home to four percent of the Nation's rural population. Table 5 documents the high and low population rural population estimates as a percentage of the Nation's total rural population. Figure 23 displays this data spatially.

Table 4 Percent of Nation’s Rural Population in 2020.

*Ranked by % of Nation’s Rural Pop 2020 (low)	State	2000	2010	2015 (Low)	2015 (High)	2020 (Low)	2020 (High)
1	Texas	6.18%	6.47%	6.48%	6.60%	6.73%	6.96%
2	North Carolina	5.42%	5.44%	5.24%	5.42%	5.09%	5.46%
3	Pennsylvania	4.78%	4.56%	4.51%	4.50%	4.39%	4.37%
4	Michigan	4.27%	4.23%	4.34%	4.21%	4.38%	4.14%
5	Ohio	4.36%	4.28%	4.34%	4.25%	4.33%	4.16%
6	New York	4.02%	3.95%	4.04%	3.94%	4.08%	3.89%
7	Georgia	3.93%	4.06%	4.00%	4.07%	3.98%	4.14%
8	Tennessee	3.51%	3.59%	3.60%	3.60%	3.64%	3.63%
9	Virginia	3.24%	3.30%	3.31%	3.32%	3.33%	3.36%
10	California	3.18%	3.16%	3.17%	3.17%	3.21%	3.21%

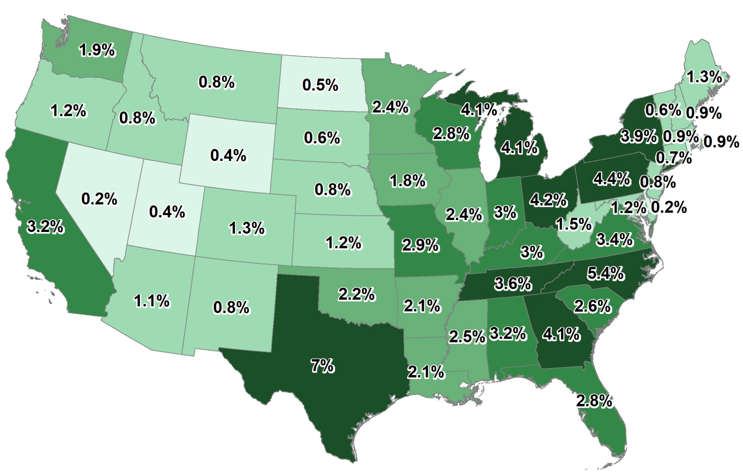


Figure 23. Percent Of Nation’s Rural Population in 2020.

3.5 Georgia’s Urbanization Trajectory

As Georgia becomes more urbanized federal transit funding for rural public transit might change. Federal transit funding is allocated to states and transit agencies based their urban and rural population size. If Georgia's share of the nation's rural population decreases, the amount of rural public transit funding the State Department of Transportation will receive from the FTA might change (NTD 2015). However, projections at the state level indicate that Georgia will continue to hold four percent of Nation's rural population. If the total amount of FTA § 5311 rural transit funding remains constant, Georgia can expect to receive a similar share to what it has received in recent years.

However, even if Georgia receives the same amount of FTA § 5311, urbanization trends within the state could change this distribution of rural transit funding. Areas that are no longer eligible to receive rural transit funding might experience a reduction in operating revenue as a result of urban rural reclassifications.

CHAPTER 4. URBAN AND RURAL TRANSITIONS AT THE COUNTY AND BLOCK LEVEL

4.1 Logistic Regression Methodology

This study uses the foundational work of Zhiyong Hu and C.P. Lo as a guide to develop a logistic regression model that predicts urban area boundaries in 2020. Although this study uses similar independent variables, urbanization is not modeled with raster data. Instead, data are compiled for every Census block in the study area and modeled in SPSS. Preforming the logistic regression model in SPSS keeps the Census block geographies intact, which results in a hard line urban area boundary. For example, the output from land-use modeling programs is a pixilated raster image that does not define hard lines, but rather illustrates a general area of change. By modeling in SPSS, the output data remain associated with the block, which allows for more precise mapping and analysis.

Similar to the Hu Lo urban growth model, this study tests the influence of population density and proximity to urban areas, major roads, and city centers on urbanization. However, this study includes Rural Urban Commuting Area Codes, Rural Urban Continuum Codes, and Urban Influence Codes, the number of jobs in the Census tract, the population change in the Census tract, and whether the block is within the Atlanta Metropolitan Statistical Area as independent variables in the initial models. The model is fit by using 2000 data to predict the urban blocks in 2010.

Two urban growth models are constructed: (1) Model 1 includes all blocks in the study area except blocks coded as water or protected (366,846 cases); and (2) Model 2 only includes the blocks that were coded as rural in 2010 (219,807 cases). The first model with both urban and rural blocks produces a higher R-squared (.861 versus .556), but the percentage of cases modeled correctly is similar (93.5 for model 1 and 92.3 percent for model 2). The complete statistical outputs for model 1 are in Appendix 1.

Using the most accurate model, three scenarios are developed based on different population density projections. Every variable in the scenarios remains the same with the exception of population density. Scenario 1 uses population density estimates that were calculated by extrapolating from the 2020 Cooper Center state population projections using the shift share method. Scenario 2 uses the same 2020 projections as a base for extrapolating, but takes the average of the population produced from the constant share, shift share, and share of growth methods. Scenario 3 takes the results from the shift share method, but uses the 2021 tract population projections developed by ESRI as a base for extrapolating. Summary of 2020 urbanization scenarios:

- Scenario 1: 2020 Population based on Weldon Copper Center's Population Projections and the Shift Share method for extrapolating population.
- Scenario 2: 2020 Population based on Weldon Copper Center's Population Projections and the Average of the Constant Share, Shift Share, and Share of Growth methods for extrapolating population.
- Scenario 3: 2021 Population based on ESRI's Population Projections and the Shift Share method for extrapolating population.

4.1.1 Data Sources

2020 Block Populations are projected using the same methodologies used for projecting the urban and rural split at the state level, but instead of the small geography being urban, the small geography is the block. The 2020 block populations are extrapolated down from the 2020 Weldon Cooper Center for Public Service state projections and the 2021 ESRI tract projections using constant share, shift share, and share of growth projection methods.

All data sources inlude:

- ESRI: 2021 Georgia Census Tract Population Projections
- Longitudinal Origin-Designation Employment Statistics (LODES) 2002, 2010, 2015 Job Data
- National Historic Geographic Information Systems (NHGIS): 2000 and 2010 Population Crosswalks
- National Historic Geographic Information Systems (NHGIS): State, County, Tract, Block, Urban Area shapefiles – Land Area and Water Area
- National Transit Database: 2015 Urban and Rural Transit Funding and Service Data
- Topologically Integrated Geographic Encoding Referencing (TIGER) Line Shapefiles: Roads, Primary Roads, City and Town Centers
- US Census Bureau: 2000 and 2010 Decennial Census Nation, State, County, Tract, and Block Urban and Rural Population data
- US Census Bureau: 2000 and 2010 Decennial Census Urban Area and Urban Cluster Population Data

- US Census Bureau: 2015 American Community Survey State, County, and Tract Population Estimates
- US Geological Survey (USGS) Protected Areas Shapefile
- Weldon Cooper Center for Public Service: 2020 National State Population Projections
- US Department of Agriculture and Economic Research USDA: 2000, 2010, Rural Urban Commuting Area, Rural Urban Continuum Codes, Urban Influence Codes, County Typology Codes

4.1.2 Data Preparation

Selecting a Study Area and Base Geographical Unit for Analysis

This study models urbanization at the Census block level because urban area boundaries follow Census blocks and do not align with higher levels of geography. As previously mentioned, urban areas can cross city, county and even state boundaries. Because of cases like the Chattanooga Urbanized Area, this study includes the states surrounding Georgia in the analysis. However, there are over one hundred thousand blocks in each state and processing that quantity of data has time and program limitations. Therefore, this study only includes the blocks from the counties bordering Georgia. This study performs 2020 urban rural population projections for all states and counties in the continental US, but urban area growth modeling is performed at the block level for only the urban areas in Georgia.

Constructing the base shapefile and dataset for the study area

The shapefile for the study area is constructed by joining Census block shapefiles for every state in the study area. Because there is such a large number of blocks in the US, the US Census or NHGIS does not provide a national Census block shapefile (a shapefile that includes every block in the US). However, the US Census Bureau does provide county Census block shapefiles (a shapefile that includes every block in a select county) and National Historical Geographic Information Systems (NHGIS) provides state Census block shapefiles (a shapefile that includes every Census block in a given state). This study uses the NHGIS 2010 TIGER/line state Census block shapefiles.

The 2010 TIGER/line state Census block shapefiles are downloaded for every state in the study area, merged in ArcMap, and then clipped to the counties of interest. This shapefile is used as the base for joining or clipping all variables in the analysis.

Joining Population Data to the Study Area

Small geographies, like Census blocks, block groups, tracts, and even counties change after each Decennial Census. For example, one block in 2000 might be divided into three blocks in 2010. This change in geographies makes comparing data between 2000 and 2010 more challenging. To compare data between these year, the 2000 block data must be converted to 2010 block geographies. This is done by joining 2000 block data to a relationship file. The US Census Bureau and the NHGIS provide relationship files that show the interrelation between geographies over time. NHGIS' relationship files are referred to as "crosswalks" because they include an interpolation weight that can be used to compute summary statistics, such as total population. The interpolation weight represents the portion of a source geography's characteristics that should be allocated to the target geography (NHGIS 2017).

The NHGIS 2000-2010 Block Crosswalks are joined to the 2000 block populations of each state surrounding Georgia. It is important to note that the crosswalk is performed on all the blocks within in each state, before the state geographies are clipped to the bordering counties. This is done to make sure all necessary block weights are included in the calculations. The files are joined in Microsoft Access by the Census block GEOID. Table 6 is an example of the output table and the highlighted rows shows how one block in 2000 can be split into multiple blocks.

Table 5. Sample of NHGIS Crosswalk Applied to 2000 and 2010 Block Populations.

2000 Block GEOID	2010 Block GEOID	WEIGHT (NHGIS)	2000 Population (Census)	Calculated 2000 Population on 2010 Block Geography
130019501001000	130019501001001	1	0	0
130019501001001	130019501001056	0.594985881	38	22.60946349
130019501001001	130019501001057	0.400896979	38	15.23408518
130019501001001	130019501001011	0.00411714	38	0.156451325
130019501001001	130019501001060	0	38	0
130019501001002	130019501001011	1	6	6
130019501001003	130019501001011	0.733627312	63	46.21852067

The 2000 block populations are then multiplied by the interpolation weight to calculate the portion of the 2000 block population that should be allocated to the joined

2010 block geography. The populations are totaled for every 2010 block geography, and the resulting number is the 2000 block population for the 2010 block geography.

The 2010, 2015, and 2020 population data as well as the 2002, 2010, and 2015 jobs data can be directly joined to the blocks in the study area by using either the Census block or Census tract GEOID because these data are already based on 2010 TIGER/line geographies.

Joining and Coding Urban Areas

The US Census Bureau's 2000 and 2010 national urbanized area and urban cluster shapefile is clipped to the study area geography then spatially joined to the study area shapefile in ArcMap. The resulting table includes the block GEOID and the name and the code of the urbanized area or urban cluster it is within in 2000 and 2010. Blocks within urban areas are coded in two ways: (1) if it is within an urbanized area or an urban cluster it is coded urban, (2) if a block is within an urbanized area it is coded as urbanized area and if a block is within an urban cluster it is coded as urban cluster. All blocks that are not in an urban area or urban cluster are consistently coded as rural for 2000 and 2010.

Once this initial coding is completed the 2010 blocks in and around urban areas area adjusted to improve model performance. In some instances, blocks are urban 2000 and then become rural in 2010 even though the block gains population. Given the US Census Bureau's methodology for defining urban areas, it is unclear as to why this happens. However, this phenomenon disrupts the model. To overcome this, this study assumes that if a block is urban in 2000 and gains population, then it remains urban in 2010. All urban and rural codes for 2010 are thus modified to fit this assumption.

Coding Water

The Census block shapefiles contain two area variables. One variable indicated the land area of the block in square meters and the other indicates the water area of the block in square meters. Blocks in the study area that contain no land area (land area equals zero) and consist completely of water are coded as water and excluded from the model.

Joining and Coding Protected Area

Some Census blocks in the study area are within “Protected Areas.” Protected areas can be national forests, state parks, military bases, or any area where development is restricted to some degree. The US Geological Survey (USGS) provides a shapefile of all the protected areas in the US that includes a code for the degree of protection (GAP Status Code). This study assumes protected areas with a Gap Status Code of one through three and an area of 100,000 square meters or more are unlikely to urbanize and excludes them from the model. To identify which blocks are in protected areas with a code one through three, the national protected area shapefile is first clipped to the study area and protected areas larger than 100,000 square meters with codes one thru three are exported as a new shapefile. This file is used to clip the blocks in the study area shapefile are then clipped to the protected area shapefile. This produces a new shapefile that contains only the blocks in the protected areas. This shapefile is then joined back to the study area shapefile and blocks with data are coded as protected.

Joining other Urban and Rural Classifications

Other urban and rural classifications are based on either county or Census tract geographies. These classifications are applied to block geographies by joining on the Census tract or county that the block is within. For example, if a block is within a tract that has a Rural Urban Commuting Areas Code (RUCA) of one, the block is assigned that RUCA code. This is done for Metropolitan Statistical Areas (MSAs), Rural Urban Commuting Area Codes, Rural Urban Continuum Codes, and Urban Influence Codes.

Creating Distance Variables

The distance of each block to urban areas (urbanized areas and urban clusters), city centers (referred to in other studies as activity centers), and primary and secondary roads is calculated by performing a near analysis in ArcMap. The near analysis measures the distance from the centroid of the block to the edge of the closest polygon of interest, like an urban area. The output table includes the block geography, the closest urban area (or road etc.), and the distance to that urban area in meters. Blocks that are in or touching an urban area are assigned a distance of zero. Blocks that are bordering the urban area are then differentiate from the blocks in the urban area by performing an if analysis. The results are two variables: a distance variable and a border block variable.

4.2 Results

Table 6. Results from Model 1

	Independent Variable	**B**	**Exp(B)**	Significance
1	Bordering urban area	-1.187	.305	.000

Table 6. Continued

2	Distance: .1 mile to .24 mile	-3.489	.031	.000
3	Distance: .25 mile to .49 mile	-4.096	.017	.000
4	Distance: .5 mile to .74 mile	-4.620	.010	.000
5	Distance: .75 mile to .99 mile	-5.002	.007	.000
6	Distance: 1 to 2.9 miles	-5.911	.003	.000
7	Distance: 3 to 4.9 miles	-6.788	.001	.000
8	Distance: 5 to 6.9 miles	-6.608	.001	.000
9	Distance: 7 to 9.9 miles	-7.253	.001	.000
10	Distance: greater than or equal to 10 miles	-6.904	.001	.000
11	100 to 500 people per square mile	-1.020	.360	.000
12	500 to 1,000 people per square mile	1.769	5.862	.000
13	1,000 to 1,500 people per square mile	2.068	7.906	.000
14	1,500 to 2,000 people per square mile	2.256	9.547	.000

Table 6. Continued

15	2,000 to 4,000 people per square mile	2.776	16.060	.000
16	Over 4,000 people per square mile	3.081	21.777	.000
17	Percent change in tract population 2000 - 2010	.674	1.962	.000
18	Natural log of the distance to roads	-.042	.959	.000
19	Natural log of the number of jobs in Census tract	.333	1.394	.000
20	Within Atlanta Metropolitan Statistical Area (MSA)	1.265	3.542	.000
21	Constant	-.166	.847	.004

The results from the modeled scenarios do not very greatly. With 90 percent or greater probability, Scenario 1 predicts Georgia will be 76.5 percent urban in 2020, Scenario 2 predicts 75.7 percent urban, and Scenario 3 predicts 77.7 percent urban. With a 50 percent or greater probability, the model predicts that Georgia could be between 81.7 and 82.5 percent urban in 2020. The results from each scenario are mapped with the 2010 urban area boundaries to illustrate the potential growth. The blue area is the 2010 urban area boundary and the red tones represent the model results. The darker red indicates 90 percent or greater probability of urbanizing, the orange represents a 75 to 89 percent probability of being urban in 2020, and the paler orange representing a 50 to 74 percent probability of being urban in 2020. Because there is not a major difference in the urbanization scenarios, it is difficult to see the difference in the large maps shown in Figures 24 – 26.

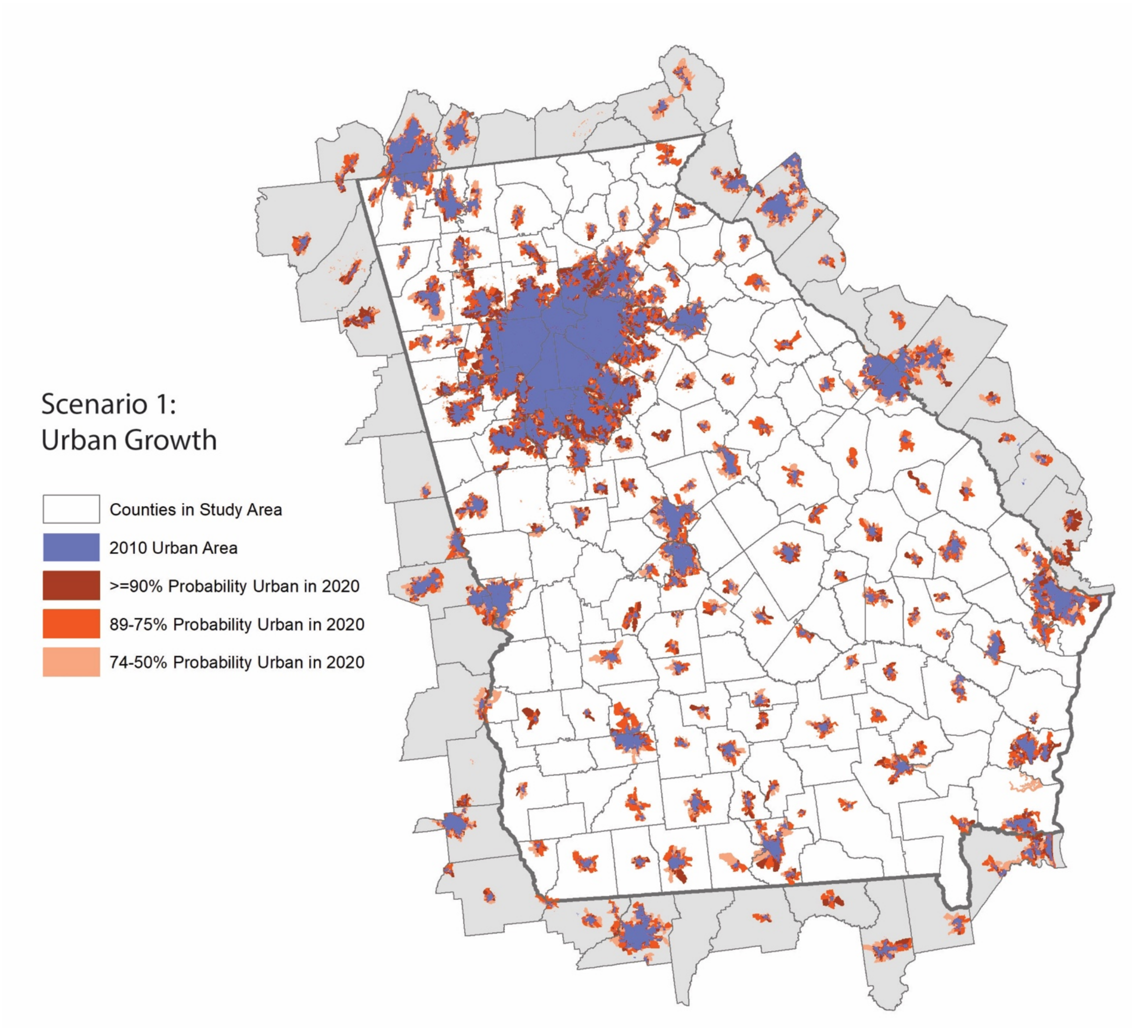
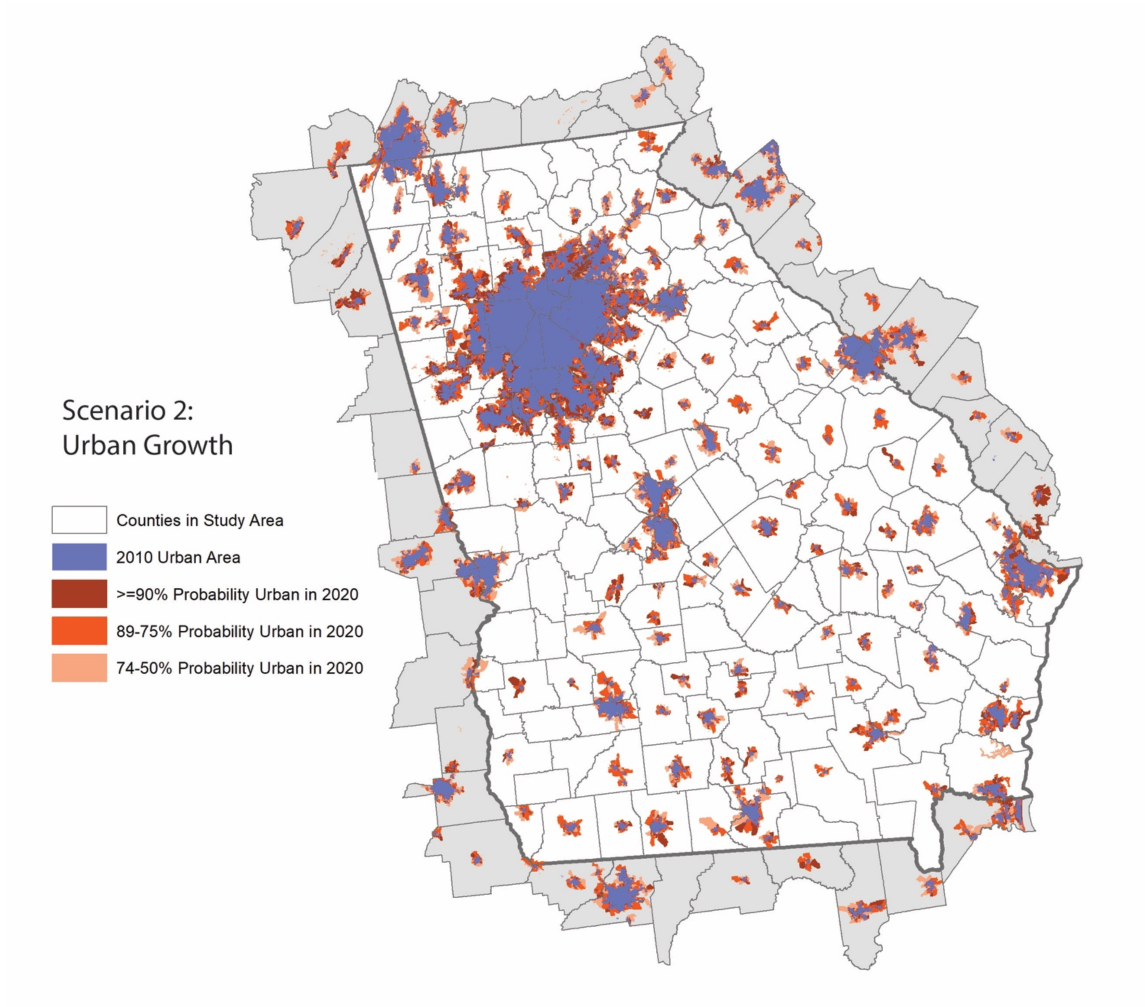


Figure 24. Scenario 1: 2020 Block Population Projections Extrapolated from the Cooper Center's 2020 State Projections Using the Shift Share Method. Data Source: 2010 Urbanized Area and 2020 model outputs.



Scenario 25. Scenario 2: 2020 Population Based on Weldon Copper Center's Population Projections and the Average of the Constant Share, Shift Share, and Share of Growth Methods for Extrapolating Population. Data Source: 2010 Urbanized Area and 2020 model outputs.

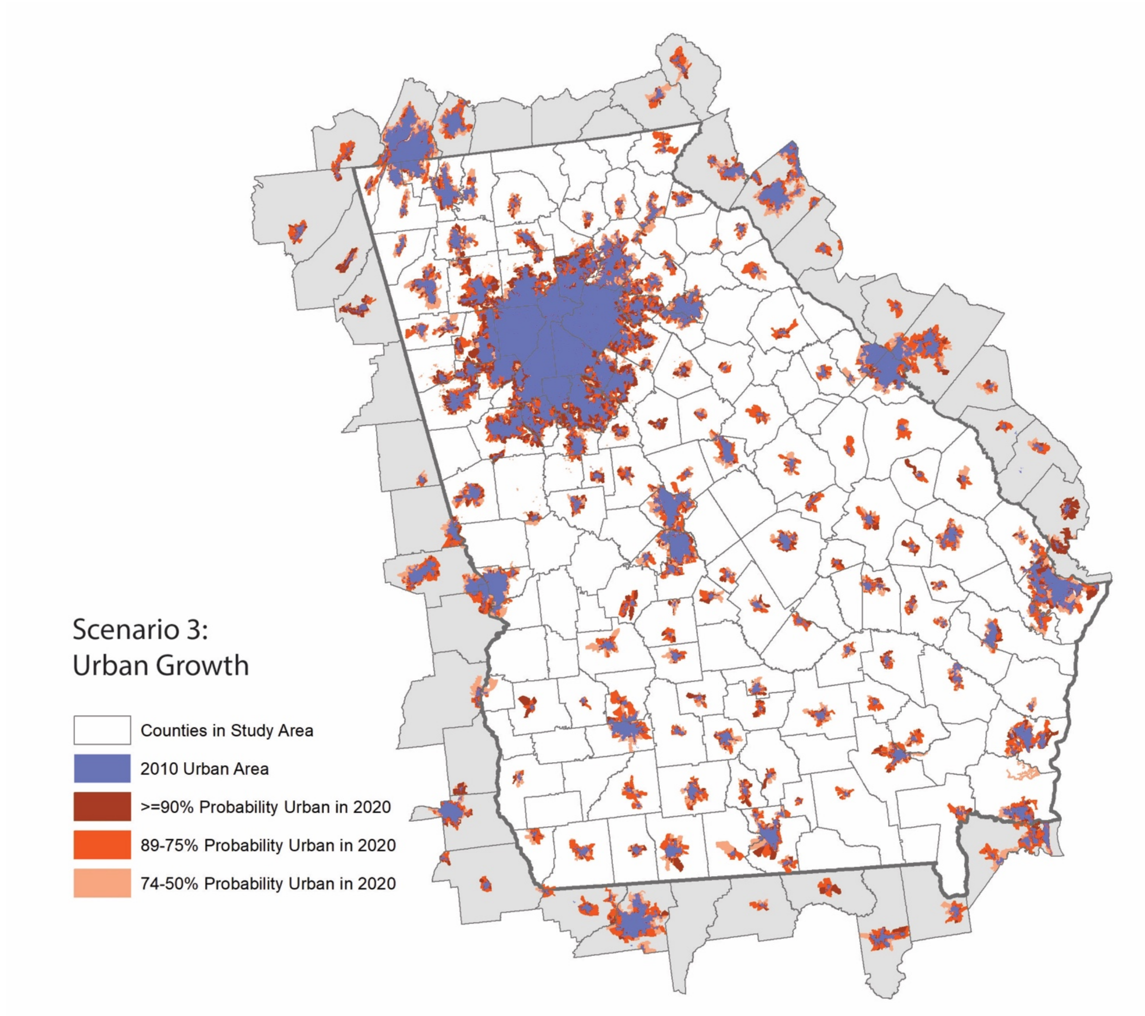


Figure 26. Scenario 3: 2021 Population Based on ESRI's Population Projections and the Shift Share Method for Extrapolating Population. Data Source: 2010 Urbanized Area and 2020 model outputs.

4.2.1 Urban Clusters to Urbanized Areas and Urban Areas Merging

Hypothetically, if no urban clusters merge together or with other urban areas, there could be two to four urban clusters that could surpass the urban cluster population threshold and transition to an urbanized area. In scenarios one and two there is a 90 percent probability that Carrollton and Winder, Georgia will have a population greater than 50,000 in 2020 and in turn will be reclassified as urban areas. There is a 50 percent probability that

Statesboro and Calhoun, Georgia will also grow to be an urbanized area by 2020. These urban clusters are called out in Figure 27 and the predicted population for these urban clusters is shown in Table 7. If these area transition to urbanized areas they will no longer be eligible to receive FTA § 5311 transit funding.

Table 7. Scenarios 1-3 2020 Urban Clusters That Could Potentially Transition To Urban Areas Based On 2020 Population Projections.

2010 Urban Cluster	2010 Population	2020 Population **(90% Probability)**	2020 Population **(75% Probability)**	2020 Population **(50% Probability)**
Scenario 1: 2020 Population - Cooper Center Shift Share				
Calhoun, GA	31,493	44,026	48,958	55,719
Carrollton, GA	42,872	58,536	63,757	64,601
Statesboro, GA	36,314	45,715	49,308	54,652
Winder, GA	37,831	62,290	72,178	74,260
Scenario 2: 2020 Population - Cooper Center Average				
Calhoun, GA	31,493	38,708	43,576	50,528
Carrollton, GA	42,872	54,694	60,053	61,030
Statesboro, GA	36,314	41,922	45,685	50,054
Winder, GA	37,831	53,328	63,158	65,141
Scenario 3: 2021 Population - ESRI Shift Share				
Calhoun, GA	31,493	37,145	41,781	48,543
Carrollton, GA	42,872	58,011	62,549	63,346
Statesboro, GA	36,314	42,898	46,336	51,324
Winder, GA	37,831	57,463	65,401	67,289

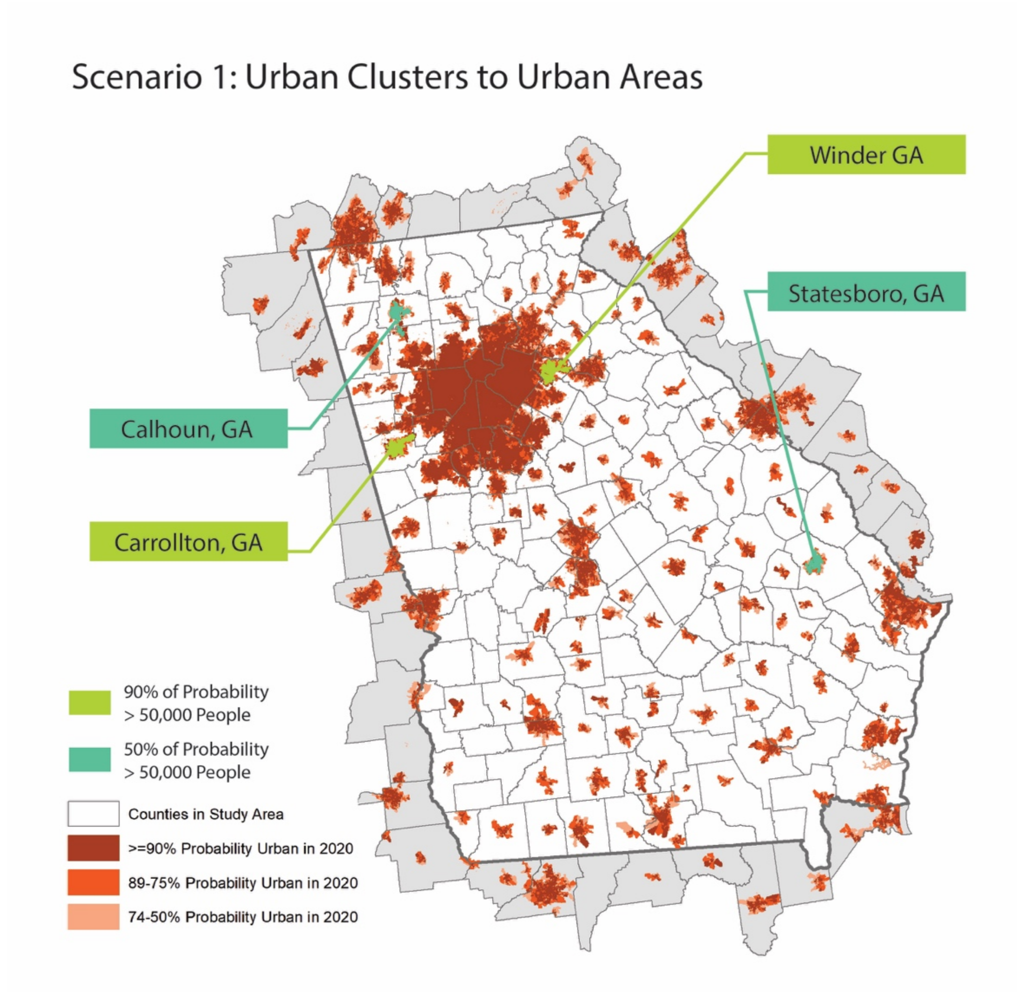


Figure 27. Study Area 2010 Urban Clusters Transition To Urban Areas In 2020.

Mapping the results makes the assumption that no urban clusters will merge with urban areas seem highly unlikely, especially around the Atlanta Urban Area. More urban clusters are likely to transition to an urbanized area with the assumption that if boundaries are touching the urban areas will merge. Figure 28 illustrates the concept of urban areas merging and calls out the three urban areas and urban clusters that could potentially be absorbed into the Atlanta Urbanized Area. If the urban clusters in this map are absorbed into the Atlanta Urbanized Area they would transition from rural to large urban funding.

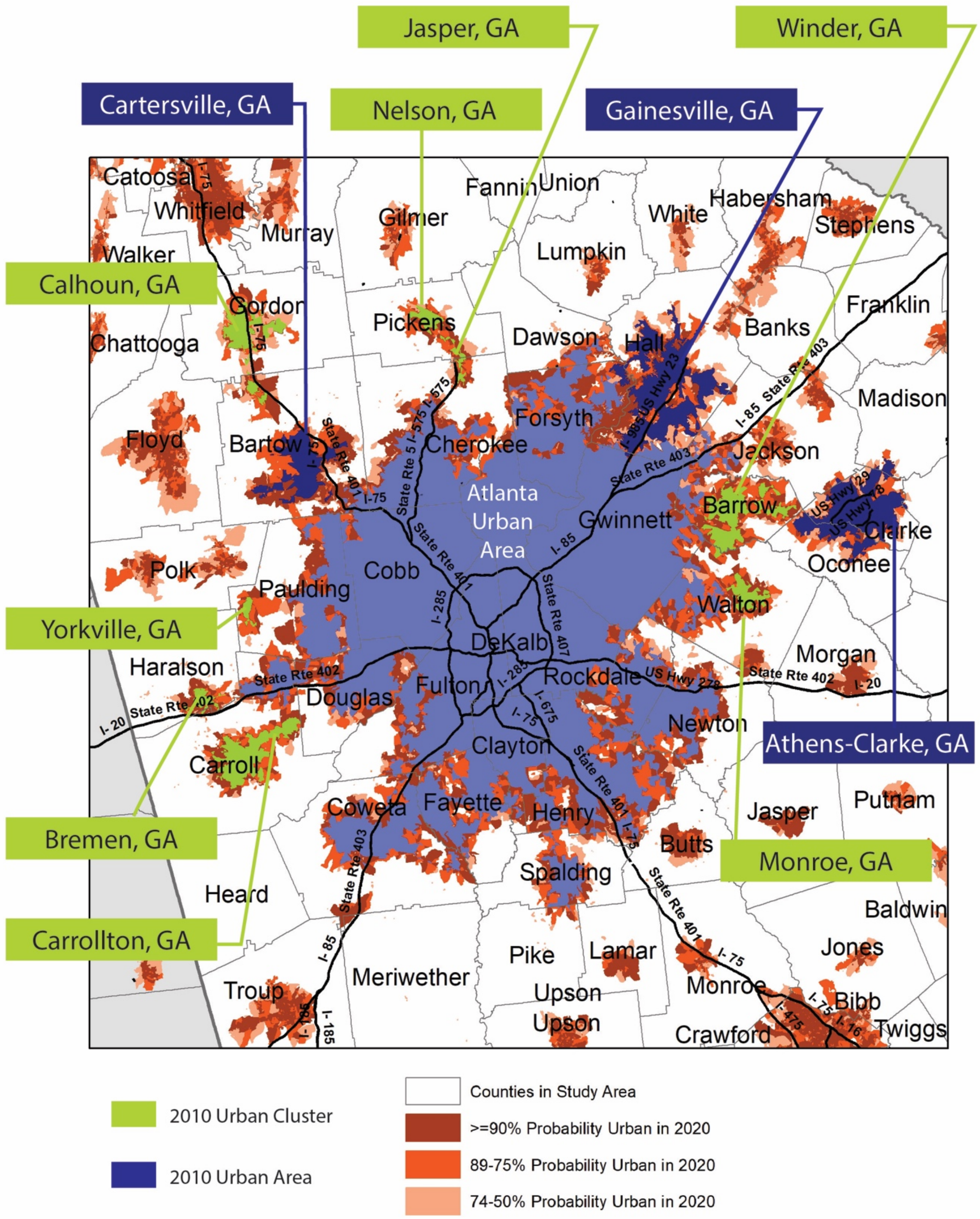


Figure 28. Potential Mergers with the Atlanta Urbanized Area.

Although the most growth is occurring the Atlanta urbanized areas, other urbanized areas like Chattanooga and Savannah are also projected to expand outward and could potentially merge with sounding urban clusters and urban areas. If the Chattanooga and Dalton urban areas merge the projected 2020 population could range from around 176,000 (scenario 3) to just over 500,000 (scenario 1). This scenario is illustrated in Figure 29. If the Savannah urbanized area merges with Ricon and Buckhead (the neighboring urban clusters) the total urbanized area population could range from nearly 300,000 to just over 375,00 people. The scenarios also suggest that there is a chance that Macon and Warner-Robinson urban areas could merge, which could result in a combined population from 300,000 to 307,000. If either of these urban area merges occur, there is a 90 percent probability that the urbanized area will move from a small urbanized area (50,000 – 200,000 people) to a large urbanized area (200,000 or more people), which would significantly change how these areas can use FTA § 5307 transit funding.

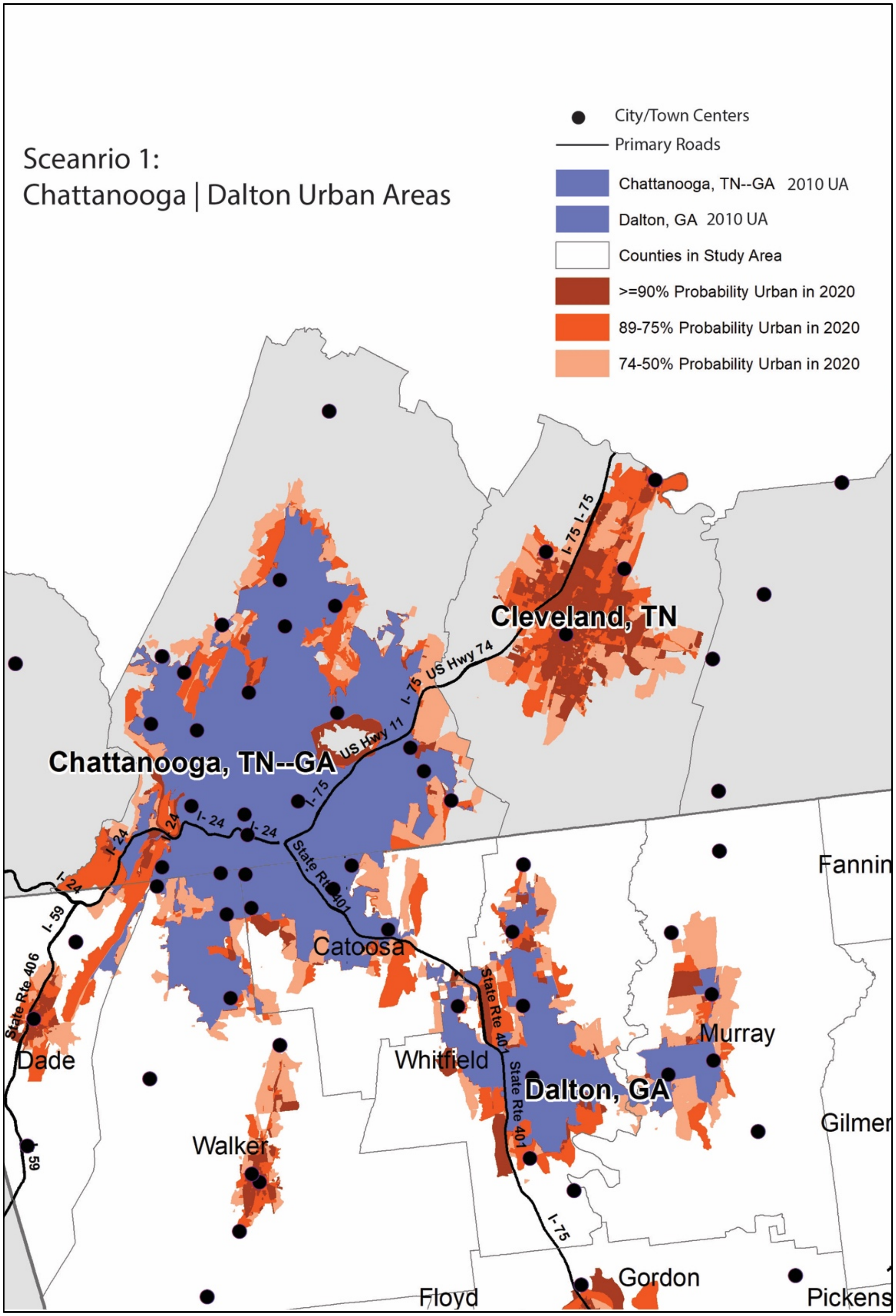


Figure 29. Chattanooga and Dalton Urbanized Area Merger

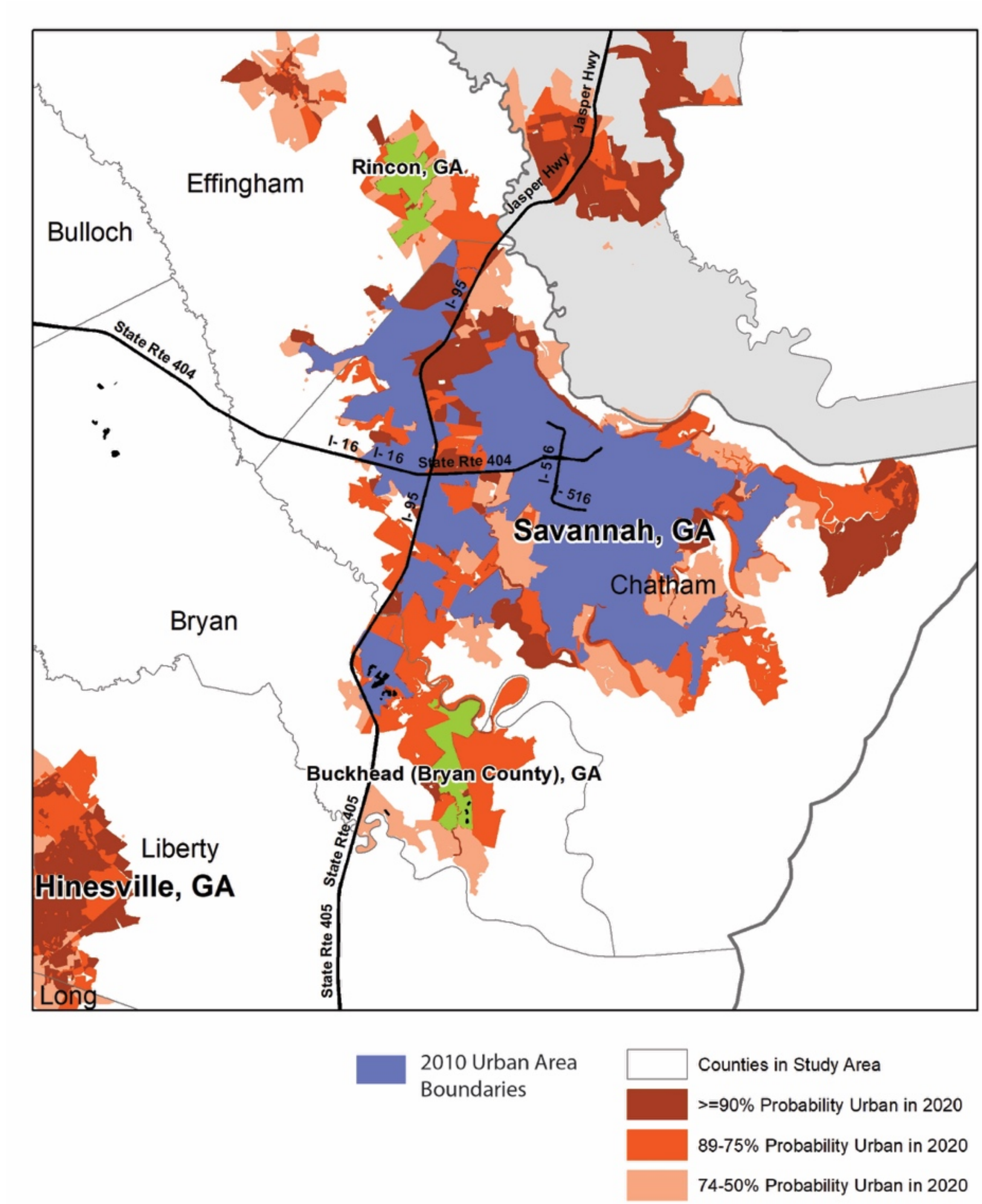


Figure 30. Savannah Urbanized Area

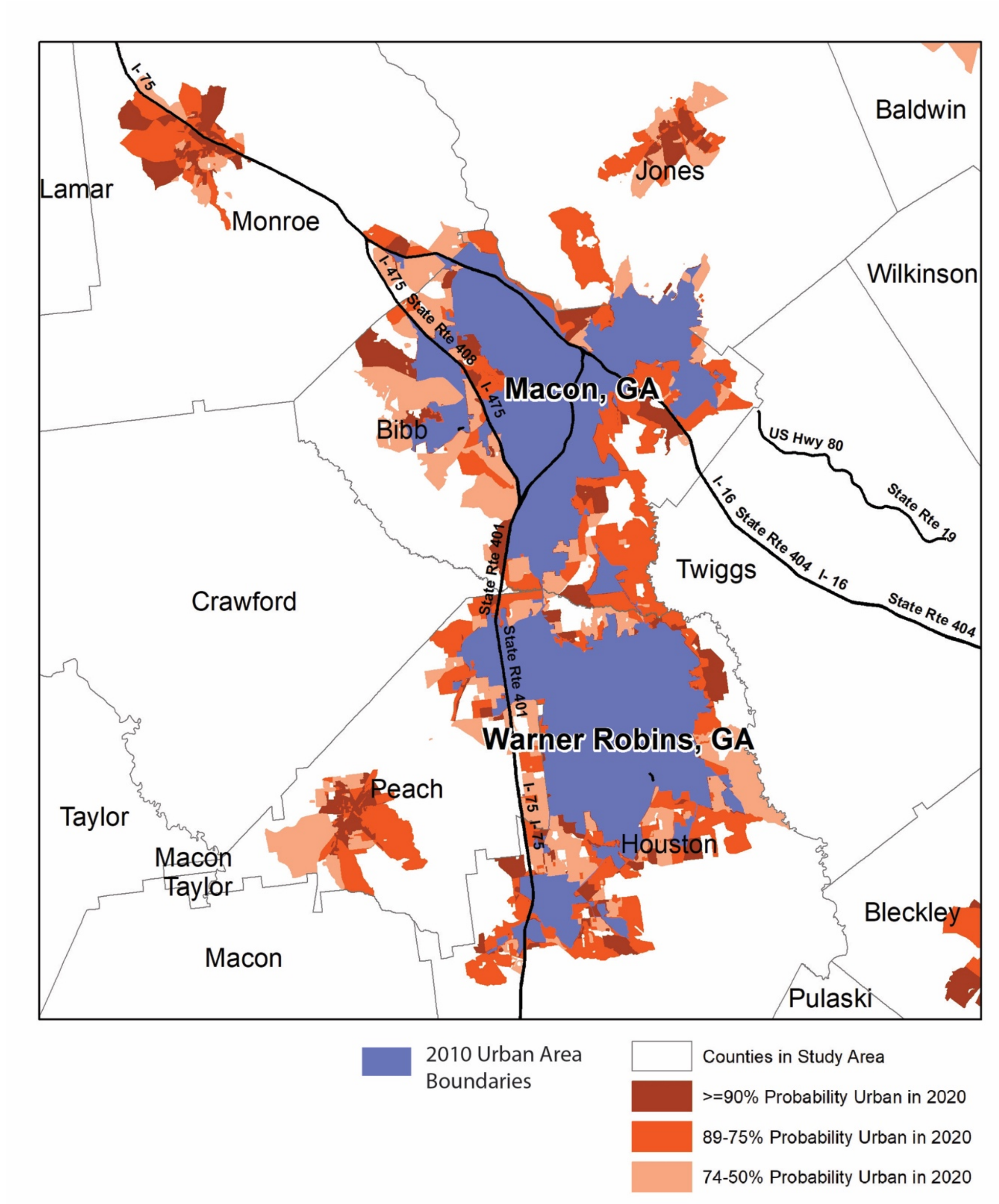


Figure 31. Macon and Warner Robins Urban Area

4.2.2 Urbanization at the County Level

To assess FTA § 5311 rural transit funding eligibility at the county level, the counties are evaluated based on the percentage of the population living in urbanized areas. A county with over 89 percent of its total population living in an urbanized area is considered urban (US Census 2016) and not potentially not eligible for FTA § 5311 funding. This definition is based on the US Census urban and rural county definition, but modified for transit funding eligibility. For example, the US Census Bureau included urban clusters in the urban population count, but because urban clusters qualify for rural public transit funding they are excluded from the urban population count in this study.

The degree of urbanization is with the 2015 transit funding conditions and areas that receive rural public transit funding, but are displaying signs of urbanization are flagged as potentially trending urban.

Assuming the highest level of urbanization (Scenario 1 with 50 percent probability) and urban area mergers, the top ten counties with the highest percent change in the number of people living in urbanized areas include: Pike, Barrow, Monroe, Carroll, Dawson, Jackson, Effingham, Walton, and Oglethorpe County. 20 counties in Georgia are predicted to have an urbanized population exceeding 89 percent of the total population. Of these 20, two received rural public transit funding in 2015 (Forsyth and Paulding), five receive urban and rural public transit (Chatham, Cherokee, Dougherty, Henry, and Richmond), and four receive no FTA funding for transit (Barrow, Fayette, Houston, and Rockdale). Figures 32 and 32 highlight which counties are predicted to have the highest percentage of people living in urban areas. Figure 33 shows the 2015 transit funding conditions with the 2020 predicted urban area boundaries.

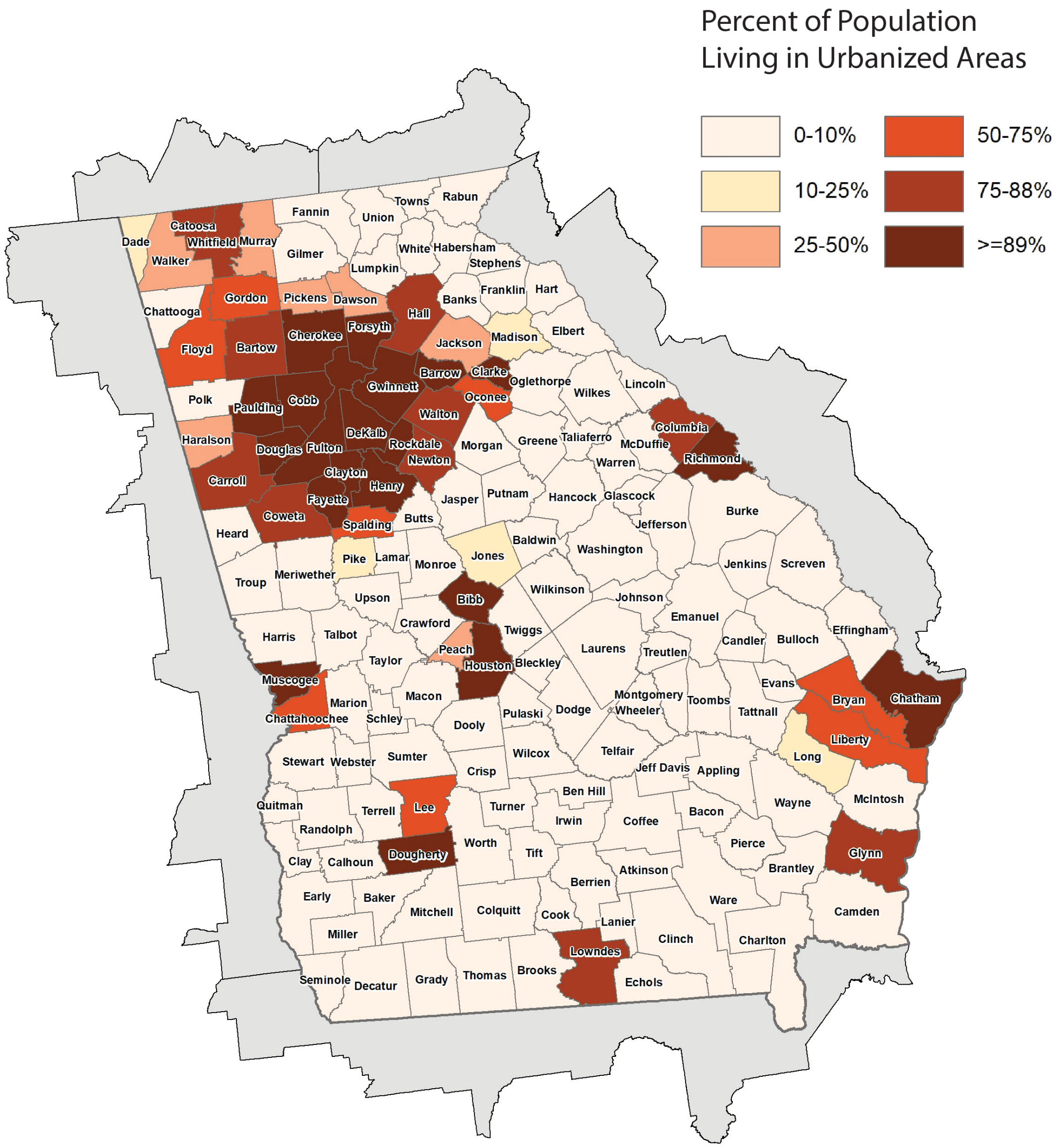


Figure 32. Urbanization Scenario 1 (with 50 Percent Probability) Percent of County Living in Urbanized Areas.

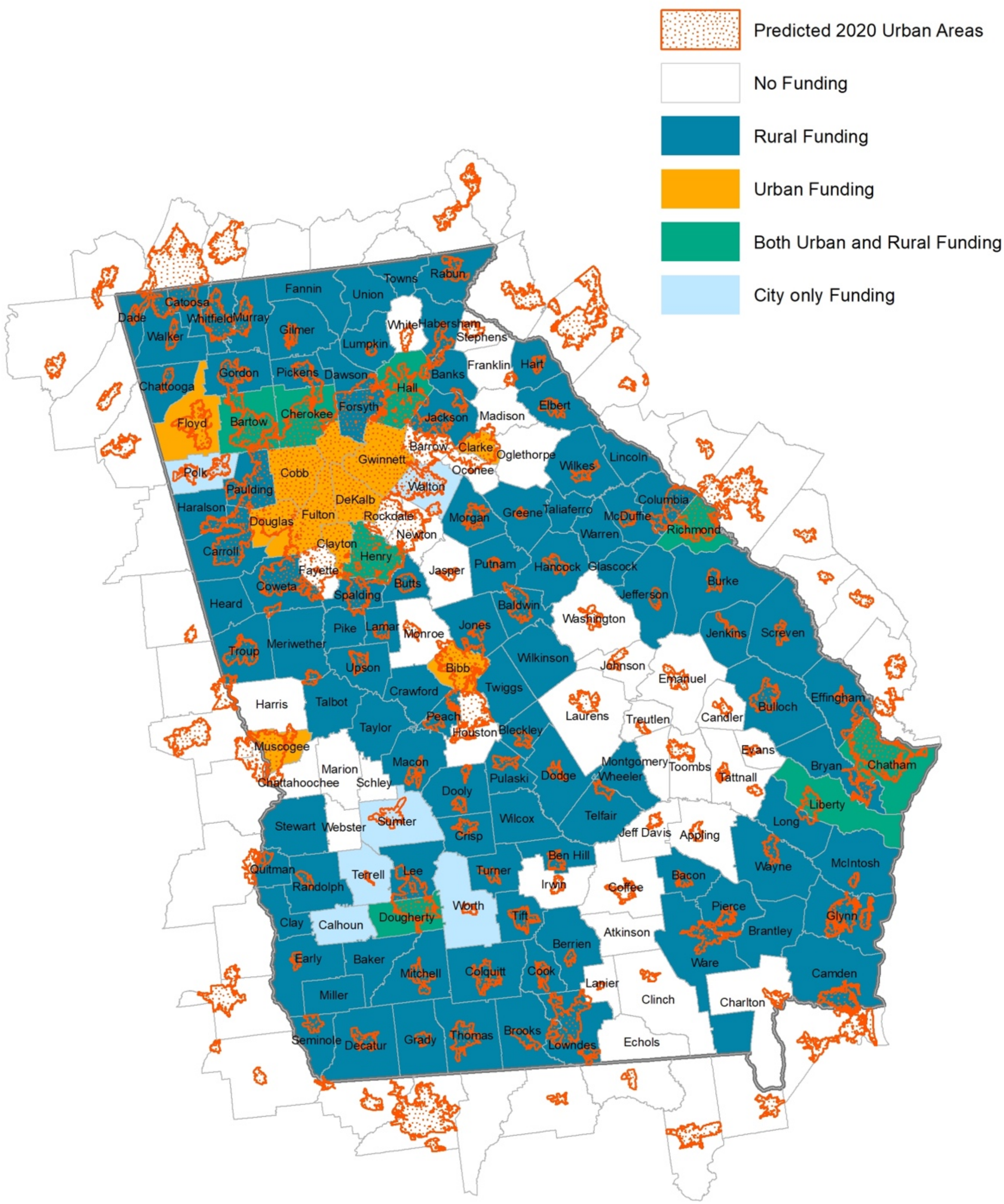


Figure 33 Urbanization Scenario 1 (with 50 Percent Probability) Urban Area Boundaries Overlaid on 2015 Transit Funding Conditions. Data sources: NTD 2015 and 2020 scenario 1 model outputs.

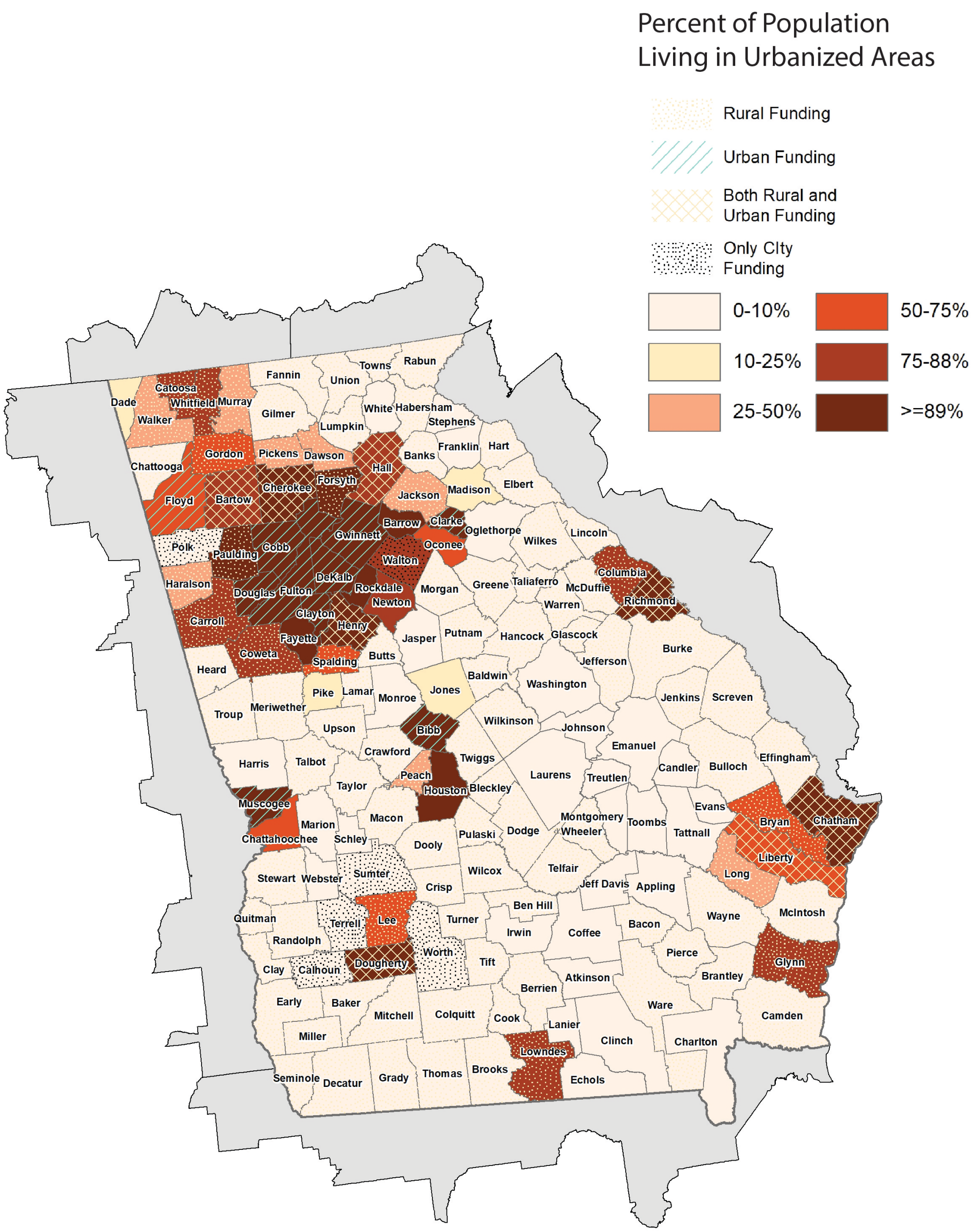


Figure 34. 2015 Transit Funding Conditions Overlaid on Model Output Scenario 1 (with 50 Percent Probability) Percent County Living in Urbanized Areas. Data sources: NTD 2015 and 2020 scenario 1 model outputs.

CHAPTER 5. CONCLUSION

5.1 Overview of Methods and Results

The purpose of this research is to study how urbanization might impact transit funding in Georgia. This thesis documents urbanization trends at state level for the nation and models urban growth at the block level for Georgia. Three urban growth scenarios are modeled using 2020 and 2021 population projections from the Weldon Cooper Center for Public Service and ESRI, respectively, and data from the US Census Bureau. The final model includes population density, percent population change, proximity to urban areas, and number of jobs as indicators to predict which blocks will be classified as urban in 2020 Decennial Census.

Based on the urban growth analysis at the state level, Georgia could be 76 to 78 percent urban in 2020. However, when modeling urbanization at the block level, results indicate Georgia's urban population in 2020 could range from 76 to 82 percent, with at most 72 percent of the population living in urbanized areas. Assuming the highest urbanization scenario, the percent of Georgia's population that qualifies for FTA § 5307 rural transit funding is expected to decrease from 35 percent in 2010 to 28 percent in 2020. Although Georgia's rural population is expected to decrease, the results from the state level urbanization projections predict that Georgia will continue to hold four percent of the nation's rural population. This might be because the national rural population is also expected to decrease.

Within Georgia, the modeled scenarios suggest that four to eleven urban clusters could transition to urbanized area as a result of population growth and urban clusters merging with larger urbanized area. With 50 percent probability and assuming no urban areas merge, four urban clusters could exceed the 50,000-person population threshold by 2020. However, if urban areas merge, eleven urban clusters could be absorbed into adjacent urbanized areas and in turn be reclassified in the 2020 Census.

Assuming the highest level of urbanization, there could be twenty counties in Georgia with an urbanized population exceeding 89 percent of the total county population. Of these, two counties receive rural public transit (Forsyth and Paulding), five receive urban and rural public transit (Chatham, Cherokee, Dougherty, Henry, and Richmond), and four receive no FTA funding for transit (Barrow, Fayette, Houston, and Rockdale). At a minimum, the counties that could be 89 percent urbanized by 2020, yet receive FTA § 5311 rural public transit funding should plan to transition to FTA § 5307 small urban transit funding. However, if the county contains an urban cluster that could merge with a large urbanized area, it should prepare to transition to FTA § 5307 large urban transit funding. Based on the high urbanization scenario, at least seven counties in Georgia might transition from rural to large urban funding and will no longer be able to use federal transit funding to cover operating expense and in turn will need to cover these costs with local sources of funding.

5.2 Next Steps

Although the model results indicate that predicts about 93 percent of modeled cases are accurate, more work is needed to vet the urbanization model's accuracy and to document the model's performance, such as tests for collinearity. In addition, this report only focuses on the model output from Scenario 1. Other studies should document the model outputs from the other scenarios in at least table form.

This report only draws attention to counties with 89 percent of its population residing in urbanized areas. It is recommended that further studies flag counties with over 75 percent urbanized population to account for the worst-case scenario. The number of counties that might be required to transition from rural to large urban could double if the percent urbanization threshold is lowered to 75 percent. Once the complete list of counties that are at risk for transitioning from rural to large urban is compiled, efforts should be made to identify resources available to aid this transition.

Additional work is needed to understand if the trending urban and transit funding issue is a national problem. The broad state level urbanizations projections preformed in this study can be used with other Census data to estimate each state's FTA § 5307 small urban and FTA § 5311 rural transit funding apportionments.

APPENDIX A. STATE LEVEL URBAN RURAL 2020

POPULATION PROJECTIONS

Table A1. Results from state-level urban and rural population projections extrapolated from the Weldon Cooper Center for Public Service 2020 state level population projections. High and low urbanization scenarios are shown as percentages of the total 2020 projected population.

State	Urban High	Urban Low	Rural High	Rural Low
Alabama	63%	59%	41%	37%
Alaska	68%	65%	35%	32%
Arizona	91%	90%	10%	9%
Arkansas	60%	56%	44%	40%
California	95%	95%	5%	5%
Colorado	88%	86%	14%	12%
Connecticut	89%	88%	12%	11%
Delaware	87%	83%	17%	13%
District Of Columbia	100%	100%	0%	0%
Florida	93%	91%	9%	7%
Georgia	78%	75%	25%	22%
Hawaii	92%	92%	8%	8%
Idaho	75%	71%	29%	25%
Illinois	89%	88%	12%	11%
Indiana	74%	72%	28%	26%

Table A1. Continued

Iowa	67%	64%	36%	33%
Kansas	77%	74%	26%	23%
Kentucky	61%	58%	42%	39%
Louisiana	75%	73%	27%	25%
Maine	41%	37%	63%	59%
Maryland	88%	87%	13%	12%
Massachusetts	93%	92%	8%	7%
Michigan	76%	74%	26%	24%
Minnesota	76%	73%	27%	24%
Mississippi	51%	49%	51%	49%
Missouri	72%	70%	30%	28%
Montana	58%	56%	44%	42%
Nebraska	77%	73%	27%	23%
Nevada	97%	94%	6%	3%
New Hampshire	62%	60%	40%	38%
New Jersey	95%	95%	5%	5%
New Mexico	80%	77%	23%	20%
New York	89%	88%	12%	11%
North Carolina	72%	66%	34%	28%
North Dakota	77%	60%	40%	23%
Ohio	79%	78%	22%	21%
Oklahoma	68%	66%	34%	32%
Oregon	83%	81%	19%	17%

Table A1. Continued

Pennsylvania	80%	79%	21%	20%
Rhode Island	91%	90%	10%	9%
South Carolina	72%	66%	34%	28%
South Dakota	62%	57%	43%	38%
Tennessee	69%	66%	34%	31%
Texas	87%	85%	15%	13%
Utah	93%	91%	9%	7%
Vermont	41%	39%	61%	59%
Virginia	78%	75%	25%	22%
Washington	86%	84%	16%	14%
West Virginia	51%	48%	52%	49%
Wisconsin	72%	70%	30%	28%
Wyoming	67%	64%	36%	33%

APPENDIX B. MODEL RESULTS

Table B1. Urbanized Areas 2020 Population Projections with 50 Percent Probability.

		2020 Population 50% Probability		
Urbanized Areas	2010 Population	Scenario 1	Scenario 2	Scenario 3
Albany, GA	95,779	102,998	108,139	107,003
Anderson, SC	75,702	91,530	90,800	0
Athens-Clarke County, GA	128,754	158,555	156,147	163,979
Atlanta, GA	4,515,419	5,670,610	5,426,118	5,829,708
Auburn, AL	74,741	96,023	89,670	0
Augusta-Richmond County, GA--SC	386,787	456,647	455,636	355,973
Brunswick, GA	51,024	71,148	67,155	67,836
Cartersville, GA	52,477	82,426	76,289	74,761
Chattanooga, TN--GA	381,112	433,131	430,799	91,683
Cleveland, TN	66,777	85,051	83,031	0
Columbus, GA--AL	253,602	275,758	278,436	227,665
Dalton, GA	85,239	118,891	113,355	112,147
Dothan, AL	68,781	78,778	75,733	0
Gainesville, GA	130,846	178,731	169,434	170,712
Greenville, SC	400,492	48,525	46,660	0
Hinesville, GA	51,456	55,388	56,549	60,315

Table B1. Continued

Macon, GA	137,570	147,985	154,565	156,476
Rome, GA	60,851	73,105	74,915	76,370
Savannah, GA	260,677	314,130	305,926	362,998
Tallahassee, FL	240,223	292,691	289,845	0
Valdosta, GA	77,085	102,746	97,495	102,845
Warner Robins, GA	133,109	183,380	172,190	182,829

Table B2. Urbanized Areas 2020 Population Projections with 90 Percent Probability.

		2020 Population 90% Probability		
Urbanized Areas	**2010 Population**	Scenario 1	Scenario 2	Sceanrio 3
Albany, GA	95,779	94,249	97,936	96,811
Anderson, SC	75,702	80,997	79,483	0
Athens-Clarke County, GA	128,754	140,979	138,424	147,768
Atlanta, GA	4,515,419	5,524,382	5,271,061	5,704,122
Auburn, AL	74,741	88,521	80,289	0
Augusta-Richmond County, GA--SC	386,787	424,633	419,935	347,185
Brunswick, GA	51,024	62,338	59,597	58,917
Cartersville, GA	52,477	73,240	67,823	66,305
Chattanooga, TN--GA	381,112	398,446	396,860	80,030
Cleveland, TN	66,777	71,240	69,885	0
Columbus, GA--AL	253,602	263,038	266,335	222,898

Table B2. Continued

Dalton, GA	85,239	102,894	95,812	96,224
Dothan, AL	68,781	70,338	66,983	0
Gainesville, GA	130,846	162,430	153,479	154,939
Greenville, SC	400,492	35,480	33,120	0
Hinesville, GA	51,456	53,854	55,072	58,660
Macon, GA	137,570	129,582	135,840	139,164
Rome, GA	60,851	60,482	61,465	64,018
Savannah, GA	260,677	299,858	290,456	350,479
Tallahassee, FL	240,223	277,186	274,803	0
Valdosta, GA	77,085	94,094	89,507	95,991
Warner Robins, GA	133,109	166,806	156,600	167,910

Table B3. Urban Clusters 2020 Population Projections with 50 Percent Probability.

		2020 Population 50% Probability		
Urban Cluster	**2010 Population**	Scenario 1	Scenario 2	Scenario 3
Abbeville, SC	5,243	5,771	6,511	0
Adel, GA	6,986	8,857	9,096	9,774
Allendale, SC	3,307	3,639	3,917	0
Alma, GA	3,408	4,753	4,901	4,834
Americus, GA	19,106	22,316	23,291	22,450
Ashburn, GA	4,489	4,749	5,187	5,193

Table B3. Continued

Bainbridge, GA	12,118	16,368	16,667	16,235
Barnesville, GA	7,167	9,785	9,630	9,265
Barnwell, SC	3,949	5,263	5,544	0
Baxley, GA	5,208	7,101	7,318	7,295
Belton, SC	5,443	6,301	6,643	0
Blackshear, GA	3,873	6,713	6,697	6,039
Blakely, GA	3,748	4,090	4,628	4,953
Bremen, GA	6,516	12,425	11,845	12,171
Buckhead (Bryan County), GA	5,168	11,770	10,314	13,609
Cairo, GA	9,414	10,502	11,084	10,851
Calhoun, GA	31,493	55,719	50,528	48,543
Camilla, GA	6,939	8,125	8,689	8,572
Carrollton, GA	42,872	64,601	61,030	63,346
Cedartown, GA	12,502	15,762	16,426	16,066
Centre, AL	3,707	8,439	8,019	0
Chattahoochee, FL	5,508	6,983	6,960	28
Claxton, GA	4,259	5,686	5,730	6,178
Clayton, GA	3,372	6,664	6,649	6,830
Cleveland, GA	4,399	9,954	9,075	8,549
Cochran, GA	6,324	8,590	8,400	8,280
Commerce, GA	6,624	11,296	10,604	10,525
Cordele, GA	12,416	14,007	14,826	13,712
Cornelia--Baldwin, GA	18,578	27,633	27,130	27,256

Table B3. Continued

Cullowhee, NC	10,837	22,197	21,077	0
Cuthbert, GA	3,811	4,303	4,522	4,422
Dahlonega, GA	4,812	9,896	8,716	9,308
Darien, GA	3,682	4,770	4,769	4,639
Dawson, GA	4,466	4,215	4,776	5,060
Donalsonville, GA	2,745	3,312	3,627	3,878
Douglas, GA	14,154	18,438	18,542	19,412
Dublin, GA	20,999	23,175	24,546	24,980
Eastman, GA	6,053	8,940	8,760	8,403
Eatonton, GA	3,889	4,984	5,602	5,497
Edgefield, SC	4,562	8,093	7,212	0
Elberton, GA	5,925	7,749	8,632	8,673
Ellijay, GA	3,496	8,072	8,018	8,825
Eufaula, AL--GA	9,520	10,709	11,360	807
Fernandina Beach, FL	25,239	38,162	36,889	0
Fitzgerald, GA	11,638	13,206	13,640	14,014
Folkston, GA	5,961	9,842	9,151	10,176
Forsyth, GA	4,834	6,520	6,762	6,571
Fort Payne, AL	7,018	12,274	11,693	0
Fort Valley, GA	10,605	13,624	13,325	11,729
Franklin, NC	6,781	13,692	13,648	0
Glennville, GA	3,161	4,382	4,552	4,292
Graceville, FL	4,037	6,993	6,227	0

Table B3. Continued

Grantville, GA	2,571	5,777	4,843	5,519
Gray, GA	4,566	10,151	8,039	8,311
Greensboro, GA	2,759	3,448	3,639	3,965
Greenwood, SC	42,103	901	808	0
Hampton, SC	4,540	5,877	6,093	0
Hardeeville, SC	2,957	5,615	5,457	0
Harlem, GA	2,705	4,145	3,955	4,892
Hartwell, GA	5,884	8,254	8,433	8,247
Havana, FL	2,771	3,651	3,998	0
Hawkinsville, GA	3,999	11,019	7,919	7,114
Hazlehurst, GA	4,594	7,156	6,984	6,616
Headland, AL	3,240	7,216	6,571	0
Homerville, GA	2,690	3,700	3,815	3,922
Honea Path, SC	3,505	4,213	4,395	0
Jackson, GA	5,218	10,822	10,587	9,738
Jasper, FL	5,404	10,261	9,074	0
Jasper, GA	5,909	11,731	10,905	11,197
Jasper, TN	3,281	4,468	4,521	0
Jefferson, GA	10,443	21,670	17,493	19,809
Jesup, GA	12,660	21,284	20,104	20,042
LaFayette, GA	7,364	11,629	11,783	10,798
LaGrange, GA	34,879	44,243	44,542	45,666
Lake City, FL	25,623	44,013	41,861	0

Table B3. Continued

Lake Park, GA	3,367	6,207	5,993	6,022
Lakeland, GA	2,910	4,112	3,972	3,253
Leesburg, GA	3,631	5,588	5,432	6,505
Louisville, GA	3,273	3,382	3,738	3,793
Lula, GA	2,591	6,091	5,464	5,213
Macclenny, FL	10,984	17,773	17,183	0
Madison, FL	3,843	4,955	5,217	0
Madison, GA	4,401	6,701	6,405	6,694
Manchester, GA	4,096	6,446	6,218	6,596
Marianna, FL	6,086	7,554	7,971	0
McRae, GA	8,747	15,316	13,003	12,925
Metter, GA	3,633	5,029	5,064	4,556
Milledgeville, GA	29,808	36,830	36,622	39,789
Millen, GA	2,827	2,841	3,267	3,909
Monroe, GA	15,854	24,580	23,478	24,258
Montezuma, GA	6,900	8,841	8,896	7,853
Monticello, GA	2,535	3,127	3,276	2,599
Moultrie, GA	18,677	25,231	25,838	27,631
Nashville, GA	4,601	5,320	5,594	5,145
Nassau Village-Ratliff, FL	5,243	9,411	8,915	0
Nelson, GA	4,091	9,885	8,926	10,196
Ocilla, GA	3,366	4,247	4,237	4,383
Pelham, GA	3,750	4,225	4,531	4,439

Table B3. Continued

Quincy, FL	9,292	13,707	13,760	0
Quitman, GA	3,769	4,009	4,608	4,866
Reidsville, GA	4,945	10,258	8,792	9,885
Ridgeland, SC	5,301	12,381	10,866	0
Rincon, GA	12,111	20,310	18,231	19,326
Roanoke, AL	4,275	5,023	5,357	0
Rockmart, GA	7,646	12,532	12,439	12,468
Royston, GA	3,002	4,399	4,596	4,466
Sandersville, GA	7,288	8,101	9,041	9,567
Scottsboro, AL	10,069	12,554	12,634	0
Seneca, SC	26,054	37,138	36,271	0
Social Circle, GA	3,328	5,691	5,419	5,594
Soperton, GA	2,832	3,028	3,411	3,333
South Pittsburg, TN--AL	5,373	6,049	6,504	0
Sparta, GA	3,622	3,963	4,540	4,403
Springfield, GA	3,649	6,458	6,136	6,040
St. Marys--Kingsland, GA	34,630	45,570	44,327	45,341
St. Simons, GA	12,226	12,586	13,802	15,716
Statesboro, GA	36,314	54,652	50,054	51,324
Summerville, GA	11,041	12,533	13,445	12,633
Sun City Hilton Head, SC	12,555	1,563	1,219	0
Swainsboro, GA	7,484	9,632	9,963	9,815

Table B3. Continued

Sylvania, GA	3,076	4,289	4,668	4,936
Sylvester, GA	6,685	7,124	7,526	7,642
Thomaston, GA	14,416	14,621	16,149	16,268
Thomasville, GA	24,139	30,093	31,257	32,624
Thomson, GA	8,540	10,886	11,294	11,249
Tifton, GA	23,757	28,858	29,108	29,023
Toccoa, GA	10,846	13,768	14,600	15,097
Trenton, GA	2,850	4,801	4,639	4,959
Tybee Island, GA	3,202	2,732	3,159	4,778
Unadilla, GA	3,406	6,423	5,391	5,547
Valley--Lanett, AL--GA	20,760	22,401	23,833	4,553
Vidalia, GA	13,442	17,104	17,600	17,903
Vienna, GA	3,506	5,368	5,033	4,287
Washington, GA	3,457	4,037	4,478	4,243
Waycross, GA	25,723	30,734	32,249	30,364
Waynesboro, GA	5,830	8,280	8,030	7,604
Winder, GA	37,831	74,260	65,141	67,289
Woodville, FL	5,427	2,388	2,547	0
Wrightsville, GA	3,452	5,122	4,852	4,578
Yorkville, GA	3,289	15,186	12,193	12,334
Yulee, FL	7,534	15,544	14,519	0

Table B4. Urban Clusters 2020 Population Projections with 90 Percent Probability.

		2020 Population 90% Probability		
Urban Cluster	**2010 Population**	Scenario 1	Scenario 2	Scenario 3
Abbeville, SC	5,243	3,885	4,880	0
Adel, GA	6,986	7,463	7,614	8,230
Allendale, SC	3,307	3,042	3,275	0
Alma, GA	3,408	3,366	3,418	3,416
Americus, GA	19,106	19,496	20,110	19,615
Ashburn, GA	4,489	4,288	4,552	4,710
Bainbridge, GA	12,118	12,488	12,865	12,421
Barnesville, GA	7,167	8,836	8,577	8,425
Barnwell, SC	3,949	3,856	4,059	0
Baxley, GA	5,208	5,612	5,591	5,790
Belton, SC	5,443	5,005	5,276	0
Blackshear, GA	3,873	4,026	4,098	3,536
Blakely, GA	3,748	3,020	3,328	3,869
Bremen, GA	6,516	9,251	8,893	9,070
Buckhead (Bryan County), GA	5,168	7,977	6,900	9,495
Cairo, GA	9,414	9,439	9,838	9,706
Calhoun, GA	31,493	44,026	38,708	37,145
Camilla, GA	6,939	6,356	6,984	6,758
Carrollton, GA	42,872	58,536	54,694	58,011
Cedartown, GA	12,502	12,704	13,250	13,096

Table B4. Continued

Centre, AL	3,707	4,964	4,793	0
Chattahoochee, FL	5,508	6,474	6,266	0
Claxton, GA	4,259	4,668	4,671	5,084
Clayton, GA	3,372	3,523	3,387	3,611
Cleveland, GA	4,399	6,525	5,823	5,582
Cochran, GA	6,324	6,970	6,769	6,696
Commerce, GA	6,624	8,367	7,945	7,786
Cordele, GA	12,416	12,032	12,560	11,459
Cornelia--Baldwin, GA	18,578	21,474	20,315	21,225
Cullowhee, NC	10,837	13,951	12,564	0
Cuthbert, GA	3,811	3,848	4,042	3,955
Dahlonega, GA	4,812	7,793	6,464	7,282
Darien, GA	3,682	4,282	4,105	3,928
Dawson, GA	4,466	4,032	4,312	4,584
Donalsonville, GA	2,745	2,573	2,609	2,997
Douglas, GA	14,154	14,864	14,456	16,079
Dublin, GA	20,999	20,468	21,833	22,396
Eastman, GA	6,053	6,701	6,639	6,171
Eatonton, GA	3,889	2,644	3,336	3,160
Edgefield, SC	4,562	7,197	6,271	0
Elberton, GA	5,925	4,888	5,748	5,913
Ellijay, GA	3,496	3,883	3,766	5,007
Eufaula, AL--GA	9,520	8,446	8,849	435

Table B4. Continued

Fernandina Beach, FL	25,239	31,447	29,052	0
Fitzgerald, GA	11,638	11,317	11,649	12,157
Folkston, GA	5,961	8,089	7,103	8,383
Forsyth, GA	4,834	4,736	4,883	4,748
Fort Payne, AL	7,018	8,482	8,166	0
Fort Valley, GA	10,605	12,091	11,794	10,319
Franklin, NC	6,781	6,753	6,716	0
Glennville, GA	3,161	2,703	2,905	2,649
Graceville, FL	4,037	6,651	5,742	0
Grantville, GA	2,571	5,062	4,268	4,977
Gray, GA	4,566	7,705	6,271	6,508
Greensboro, GA	2,759	2,560	2,834	3,088
Greenwood, SC	42,103	490	152	0
Hampton, SC	4,540	4,402	4,620	0
Hardeeville, SC	2,957	3,921	3,816	0
Harlem, GA	2,705	3,285	3,098	3,971
Hartwell, GA	5,884	6,567	6,422	6,587
Havana, FL	2,771	2,530	2,775	0
Hawkinsville, GA	3,999	4,198	4,500	3,418
Hazlehurst, GA	4,594	5,230	4,967	4,816
Headland, AL	3,240	4,549	4,200	0
Homerville, GA	2,690	2,468	2,652	2,707
Honea Path, SC	3,505	3,478	3,750	0

Table B4. Continued

Jackson, GA	5,218	7,171	6,494	6,560
Jasper, FL	5,404	9,170	7,923	0
Jasper, GA	5,909	8,934	7,844	8,643
Jasper, TN	3,281	3,345	3,232	0
Jefferson, GA	10,443	17,955	14,639	16,797
Jesup, GA	12,660	15,413	14,645	14,290
LaFayette, GA	7,364	7,852	7,797	7,148
LaGrange, GA	34,879	37,345	37,888	39,144
Lake City, FL	25,623	35,608	32,186	0
Lake Park, GA	3,367	3,634	3,516	3,544
Lakeland, GA	2,910	3,489	3,343	2,819
Leesburg, GA	3,631	4,594	4,242	5,329
Louisville, GA	3,273	2,908	3,212	3,338
Lula, GA	2,591	4,498	3,682	3,877
Macclenny, FL	10,984	13,678	13,068	0
Madison, FL	3,843	4,237	4,321	0
Madison, GA	4,401	5,536	5,610	5,547
Manchester, GA	4,096	4,382	4,638	4,520
Marianna, FL	6,086	6,395	6,673	0
McRae, GA	8,747	14,257	11,994	12,019
Metter, GA	3,633	3,784	3,979	3,397
Milledgeville, GA	29,808	30,673	29,915	34,033
Millen, GA	2,827	2,291	2,635	3,167

Table B4. Continued

Monroe, GA	15,854	21,622	20,189	21,179
Montezuma, GA	6,900	7,712	7,658	6,806
Monticello, GA	2,535	2,941	3,017	2,405
Moultrie, GA	18,677	19,582	19,785	21,567
Nashville, GA	4,601	4,543	4,863	4,413
Nassau Village-Ratliff, FL	5,243	6,418	6,175	0
Nelson, GA	4,091	7,010	6,151	7,252
Ocilla, GA	3,366	3,958	3,817	4,044
Pelham, GA	3,750	3,412	3,685	3,564
Quincy, FL	9,292	10,780	10,607	0
Quitman, GA	3,769	2,898	3,360	3,653
Reidsville, GA	4,945	8,006	6,625	8,412
Ridgeland, SC	5,301	10,276	8,964	0
Rincon, GA	12,111	17,140	15,199	16,484
Roanoke, AL	4,275	3,861	4,020	0
Rockmart, GA	7,646	8,643	8,228	8,580
Royston, GA	3,002	3,264	3,233	3,302
Sandersville, GA	7,288	6,752	7,359	7,918
Scottsboro, AL	10,069	9,332	9,486	0
Seneca, SC	26,054	29,766	28,669	0
Social Circle, GA	3,328	4,200	4,010	4,130
Soperton, GA	2,832	2,524	2,829	2,828

Table B4. Continued

South Pittsburg, TN--AL	5,373	4,678	5,059	0
Sparta, GA	3,622	2,742	3,085	3,060
Springfield, GA	3,649	4,669	4,249	4,535
St. Marys--Kingsland, GA	34,630	40,933	39,137	40,839
St. Simons, GA	12,226	10,809	12,216	13,925
Statesboro, GA	36,314	45,715	41,922	42,898
Summerville, GA	11,041	9,907	10,465	9,915
Sun City Hilton Head, SC	12,555	1,357	1,057	0
Swainsboro, GA	7,484	7,480	7,507	7,576
Sylvania, GA	3,076	3,000	3,153	3,421
Sylvester, GA	6,685	6,329	6,823	6,919
Thomaston, GA	14,416	12,187	13,828	13,763
Thomasville, GA	24,139	23,248	24,563	26,333
Thomson, GA	8,540	8,668	8,948	8,903
Tifton, GA	23,757	26,191	25,816	26,168
Toccoa, GA	10,846	10,109	10,577	10,868
Trenton, GA	2,850	3,531	3,414	3,612
Tybee Island, GA	3,202	2,236	2,750	4,567
Unadilla, GA	3,406	5,869	4,807	5,090
Valley--Lanett, AL--GA	20,760	16,874	18,625	3,621
Vidalia, GA	13,442	13,265	13,758	13,986

Table B4. Continued

Vienna, GA	3,506	4,627	4,213	3,583
Washington, GA	3,457	3,086	3,394	3,312
Waycross, GA	25,723	23,775	25,368	23,719
Waynesboro, GA	5,830	6,166	6,235	5,838
Winder, GA	37,831	62,290	53,328	57,463
Woodville, FL	5,427	1,977	2,109	0
Wrightsville, GA	3,452	4,579	4,145	4,074
Yorkville, GA	3,289	8,704	6,012	6,532
Yulee, FL	7,534	12,585	11,679	0

Table B5. Urbanized Area 2020 Population Projections with 50 Percent Probability Per County.

COUNTY	2020 Pop	2020 UZA Pop	2020 Percent UZA	2020 Pop Qualify for FTA § 5311	2020 Percent Qualify for FTA § 5311
Georgia	11,280,634	8,152,450	72%	3,128,184	28%
Appling	19,226	0	0%	19,226	100%
Atkinson	8,950	0	0%	8,950	100%
Bacon	11,607	0	0%	11,607	100%
Baker	3,105	0	0%	3,105	100%
Baldwin	51,725	0	0%	51,725	100%
Banks	22,037	0	0%	22,037	100%
Barrow	94,560	89,406	95%	5,154	5%

Table B5. Continued

Bartow	125,865	103,442	82%	22,423	18%
Ben Hill	17,510	0	0%	17,510	100%
Berrien	22,033	0	0%	22,033	100%
Bibb	153,688	144,378	94%	9,309	6%
Bleckley	14,407	0	0%	14,407	100%
Brantley	22,076	0	0%	22,076	100%
Brooks	15,789	1,226	8%	14,563	92%
Bryan	37,503	23,753	63%	13,750	37%
Bulloch	87,470	0	0%	87,470	100%
Burke	26,328	0	0%	26,328	100%
Butts	27,766	431	2%	27,335	98%
Calhoun	8,870	0	0%	8,870	100%
Camden	57,660	2	0%	57,658	100%
Candler	12,409	0	0%	12,409	100%
Carroll	137,432	103,973	76%	33,459	24%
Catoosa	72,935	55,620	76%	17,316	24%
Charlton	15,125	0	0%	15,125	100%
Chatham	304,710	297,749	98%	6,961	2%
Chattahoochee	9,123	5,860	64%	3,263	36%
Chattooga	25,190	0	0%	25,190	100%
Cherokee	294,303	267,701	91%	26,602	9%
Clarke	130,676	128,603	98%	2,073	2%
Clay	3,013	0	0%	3,013	100%

Table B5. Continued

Clayton	285,621	284,813	100%	808	0%
Clinch	7,109	0	0%	7,109	100%
Cobb	762,719	762,719	100%	0	0%
Coffee	48,572	0	0%	48,572	100%
Colquitt	48,802	0	0%	48,802	100%
Columbia	159,244	137,983	87%	21,261	13%
Cook	18,262	0	0%	18,262	100%
Coweta	169,453	133,115	79%	36,339	21%
Crawford	11,925	0	0%	11,925	100%
Crisp	24,891	0	0%	24,891	100%
Dade	18,495	3,109	17%	15,386	83%
Dawson	28,843	14,311	50%	14,533	50%
Decatur	27,030	0	0%	27,030	100%
DeKalb	693,419	693,419	100%	0	0%
Dodge	25,706	0	0%	25,706	100%
Dooly	20,112	0	0%	20,112	100%
Dougherty	89,630	82,398	92%	7,232	8%
Douglas	176,464	163,343	93%	13,121	7%
Early	9,303	0	0%	9,303	100%
Echols	4,249	0	0%	4,249	100%
Effingham	67,813	4,398	6%	63,415	94%
Elbert	18,683	0	0%	18,683	100%
Emanuel	23,605	0	0%	23,605	100%

Table B5. Continued

Evans	11,855	0	0%	11,855	100%
Fannin	27,373	0	0%	27,373	100%
Fayette	118,754	110,630	93%	8,124	7%
Floyd	100,072	73,105	73%	26,967	27%
Forsyth	261,898	261,253	100%	645	0%
Franklin	23,035	0	0%	23,035	100%
Fulton	1,056,513	1,053,747	100%	2,766	0%
Gilmer	33,355	0	0%	33,355	100%
Glascock	3,617	0	0%	3,617	100%
Glynn	92,524	71,146	77%	21,378	23%
Gordon	67,421	44,297	66%	23,123	34%
Grady	25,354	0	0%	25,354	100%
Greene	17,155	0	0%	17,155	100%
Gwinnett	1,031,168	1,031,026	100%	142	0%
Habersham	49,454	0	0%	49,454	100%
Hall	222,679	191,332	86%	31,347	14%
Hancock	9,129	0	0%	9,129	100%
Haralson	31,205	12,331	40%	18,874	60%
Harris	40,661	370	1%	40,291	99%
Hart	26,843	0	0%	26,843	100%
Heard	12,128	0	0%	12,128	100%
Henry	300,950	298,254	99%	2,696	1%
Houston	174,060	167,864	96%	6,195	4%

Table B5. Continued

Irwin	9,594	0	0%	9,594	100%
Jackson	81,981	22,786	28%	59,194	72%
Jasper	16,413	181	1%	16,232	99%
Jeff Davis	17,599	0	0%	17,599	100%
Jefferson	16,905	0	0%	16,905	100%
Jenkins	7,820	0	0%	7,820	100%
Johnson	11,283	0	0%	11,283	100%
Jones	34,110	5,333	16%	28,776	84%
Lamar	20,716	50	0%	20,666	100%
Lanier	13,058	0	0%	13,058	100%
Laurens	50,718	0	0%	50,718	100%
Lee	32,276	20,600	64%	11,676	36%
Liberty	67,851	50,716	75%	17,135	25%
Lincoln	7,025	0	0%	7,025	100%
Long	19,260	4,673	24%	14,587	76%
Lowndes	131,165	101,520	77%	29,645	23%
Lumpkin	40,776	0	0%	40,776	100%
McDuffie	22,029	0	0%	22,029	100%
McIntosh	18,181	0	0%	18,181	100%
Macon	15,374	0	0%	15,374	100%
Madison	29,254	3,604	12%	25,649	88%
Marion	10,357	0	0%	10,357	100%
Meriwether	21,169	0	0%	21,169	100%

Table B5. Continued

Miller	5,552	0	0%	5,552	100%
Mitchell	22,231	0	0%	22,231	100%
Monroe	30,942	2,717	9%	28,225	91%
Montgomery	10,623	0	0%	10,623	100%
Morgan	20,044	0	0%	20,044	100%
Murray	40,705	19,381	48%	21,324	52%
Muscogee	194,700	190,811	98%	3,889	2%
Newton	144,989	114,685	79%	30,304	21%
Oconee	39,150	25,604	65%	13,546	35%
Oglethorpe	16,751	299	2%	16,453	98%
Paulding	209,475	196,345	94%	13,131	6%
Peach	33,065	11,073	33%	21,992	67%
Pickens	36,365	16,553	46%	19,812	54%
Pierce	21,652	0	0%	21,652	100%
Pike	21,973	3,315	15%	18,659	85%
Polk	43,690	0	0%	43,690	100%
Pulaski	15,889	0	0%	15,889	100%
Putnam	22,945	0	0%	22,945	100%
Quitman	2,390	0	0%	2,390	100%
Rabun	17,239	0	0%	17,239	100%
Randolph	7,635	0	0%	7,635	100%
Richmond	198,298	184,560	93%	13,737	7%
Rockdale	99,264	95,851	97%	3,413	3%

Table B5. Continued

Schley	6,414	0	0%	6,414	100%
Screven	13,588	0	0%	13,588	100%
Seminole	7,666	0	0%	7,666	100%
Spalding	68,512	48,711	71%	19,801	29%
Stephens	26,317	0	0%	26,317	100%
Stewart	7,378	0	0%	7,378	100%
Sumter	32,106	0	0%	32,106	100%
Talbot	7,384	0	0%	7,384	100%
Taliaferro	1,398	0	0%	1,398	100%
Tattnall	31,797	0	0%	31,797	100%
Taylor	8,784	0	0%	8,784	100%
Telfair	23,267	0	0%	23,267	100%
Terrell	7,789	0	0%	7,789	100%
Thomas	45,250	0	0%	45,250	100%
Tift	42,010	0	0%	42,010	100%
Toombs	28,065	0	0%	28,065	100%
Towns	12,007	0	0%	12,007	100%
Treutlen	6,579	0	0%	6,579	100%
Troup	73,785	0	0%	73,785	100%
Turner	8,104	0	0%	8,104	100%
Twiggs	6,669	0	0%	6,669	100%
Union	25,307	0	0%	25,307	100%
Upson	24,832	0	0%	24,832	100%

Table B5. Continued

Walker	74,508	34,820	47%	39,688	53%
Walton	107,484	82,579	77%	24,905	23%
Ware	36,157	0	0%	36,157	100%
Warren	5,564	0	0%	5,564	100%
Washington	22,373	0	0%	22,373	100%
Wayne	35,838	0	0%	35,838	100%
Webster	3,190	0	0%	3,190	100%
Wheeler	10,026	0	0%	10,026	100%
White	34,331	0	0%	34,331	100%
Whitfield	124,446	98,575	79%	25,871	21%
Wilcox	11,631	0	0%	11,631	100%
Wilkes	10,312	0	0%	10,312	100%
Wilkinson	8,499	0	0%	8,499	100%
Worth	20,541	0	0%	20,541	100%

APPENDIX C. SPSS LOGISTIC REGRESSION MODEL

Case Processing Summary

Unweighted Cases[a]		N	Percent
Selected Cases	Included in Analysis	366846	100.0
	Missing Cases	0	.0
	Total	366846	100.0
Unselected Cases		0	.0
Total		366846	100.0

Classification Table[a]

			Predicted		
			Urb2010		
	Observed		0	1	Percentage Correct
Step 1	Urb2010	0	183660	14520	92.7
		1	9445	159221	94.4
	Overall Percentage				93.5

Contingency Table for Hosmer and Lemeshow Test

		Urb2010 = 0		Urb2010 = 1		
		Observed	Expected	Observed	Expected	Total
Step 1	1	36618	36565.111	67	119.889	36685
	2	36583	36447.392	102	237.608	36685
	3	36344	36299.028	341	385.972	36685
	4	35719	35808.837	952	862.163	36671
	5	32529	32860.270	4156	3824.730	36685
	6	14415	14228.004	22273	22459.996	36688
	7	4393	4171.519	32297	32518.481	36690
	8	1057	1220.651	35628	35464.350	36685
	9	390	428.350	36295	36256.650	36685
	10	132	150.839	36555	36536.161	36687

Variables in the Equation

		B	S.E.	Wald	df	Sig.
Step 1[a]	BorderUAZ00	-1.187	.029	1641.384	1	.000
	DIST_UAZ00_CAT=3.0	-3.489	.042	6819.909	1	.000
	DIST_UAZ00_CAT=4.0	-4.096	.042	9645.147	1	.000

	DIST_UAZ00_CAT=5.0	-4.620	.047	9550.834	1	.000
	DIST_UAZ00_CAT=6.0	-5.002	.053	8956.097	1	.000
	DIST_UAZ00_CAT=7.0	-5.911	.038	23923.325	1	.000
	DIST_UAZ00_CAT=8.0	-6.788	.049	18965.523	1	.000
	DIST_UAZ00_CAT=9.0	-6.608	.049	18556.335	1	.000
	DIST_UAZ00_CAT=10.0	-7.253	.055	17142.904	1	.000
	DIST_UAZ00_CAT=11.0	-6.904	.044	24508.809	1	.000
	OneHundred_to_FiveHundred_PSQM	-1.020	.021	2288.731	1	.000
	FiveHundred_to_OneThousand_PSQM	1.769	.030	3591.206	1	.000
	OneThousand_to_FifteenHundred_PSQM	2.068	.036	3251.125	1	.000
	FifteenHundred_to_TwoThousand_PSQM	2.256	.043	2758.148	1	.000
	TwoThousand_to_FourThousand_PSQM	2.776	.032	7338.210	1	.000
	Over_4000_PSSM	3.081	.040	6007.465	1	.000
	Tract_PCTChange_00_10	.674	.020	1132.700	1	.000
	LN_DIST_ALL_RD	-.042	.003	266.090	1	.000
	LN_TractJobs2010	.333	.007	2450.146	1	.000
	ATL_MSA_2000	1.265	.019	4271.641	1	.000

Constant	-.166	.057	8.348	1	.004

Variables in the Equation

			95% C.I.for EXP(B)	
		Exp(B)	Lower	Upper
Step 1[a]	BorderUAZ00	.305	.288	.323
	DIST_UAZ00_CAT=3.0	.031	.028	.033
	DIST_UAZ00_CAT=4.0	.017	.015	.018
	DIST_UAZ00_CAT=5.0	.010	.009	.011
	DIST_UAZ00_CAT=6.0	.007	.006	.007
	DIST_UAZ00_CAT=7.0	.003	.003	.003
	DIST_UAZ00_CAT=8.0	.001	.001	.001
	DIST_UAZ00_CAT=9.0	.001	.001	.001
	DIST_UAZ00_CAT=10.0	.001	.001	.001
	DIST_UAZ00_CAT=11.0	.001	.001	.001
	OneHundred_to_FiveHundred_PSQM	.360	.346	.376
	FiveHundred_to_OneThousand_PSQM	5.862	5.533	6.211
	OneThousand_to_FifteenHundred_PSQM	7.906	7.364	8.489
	FifteenHundred_to_TwoThousand_PSQM	9.547	8.776	10.385

	TwoThousand_to_FourThousand_PSQM	16.060	15.071	17.113
	Over_4000_PSSM	21.777	20.145	23.541
	Tract_PCTChange_00_10	1.962	1.886	2.040
	LN_DIST_ALL_RD	.959	.954	.964
	LN_TractJobs2010	1.394	1.376	1.413
	ATL_MSA_2000	3.542	3.410	3.679
	Constant	.847		

a. Variable(s) entered on step 1: BorderUAZ00, DIST_UAZ00_CAT=3.0, DIST_UAZ00_CAT=4.0, DIST_UAZ00_CAT=5.0, DIST_UAZ00_CAT=6.0, DIST_UAZ00_CAT=7.0, DIST_UAZ00_CAT=8.0, DIST_UAZ00_CAT=9.0, DIST_UAZ00_CAT=10.0, DIST_UAZ00_CAT=11.0, OneHundred_to_FiveHundred_PSQM, FiveHundred_to_OneThousand_PSQM, OneThousand_to_FifteenHundred_PSQM, FifteenHundred_to_TwoThousand_PSQM, TwoThousand_to_FourThousand_PSQM, Over_4000_PSSM, Tract_PCTChange_00_10, LN_DIST_ALL_RD, LN_TractJobs2010, ATL_MSA_2000.

Correlation Matrix

		Constant	BorderUAZ00	DIST_UAZ00_CAT=3.0	DIST_UAZ00_CAT=4.0
Step 1	Constant	1.000	-.492	-.317	-.328
	BorderUAZ00	-.492	1.000	.605	.618
	DIST_UAZ00_CAT=3.0	-.317	.605	1.000	.445
	DIST_UAZ00_CAT=4.0	-.328	.618	.445	1.000

	DIST_UAZ00_CAT=5.0	-.286	.546	.395	.410
	DIST_UAZ00_CAT=6.0	-.267	.490	.357	.371
	DIST_UAZ00_CAT=7.0	-.391	.680	.496	.519
	DIST_UAZ00_CAT=8.0	-.324	.527	.379	.395
	DIST_UAZ00_CAT=9.0	-.338	.533	.379	.393
	DIST_UAZ00_CAT=10.0	-.288	.465	.330	.341
	DIST_UAZ00_CAT=11.0	-.358	.588	.414	.430
	OneHundred_to_FiveHundred_PSQM	-.152	.071	.109	.111
	FiveHundred_to_OneThousand_PSQM	-.116	.018	-.007	-.034
	OneThousand_to_FifteenHundred_PSQM	-.096	.017	.001	-.015
	FifteenHundred_to_TwoThousand_PSQM	-.082	.012	.004	-.005
	TwoThousand_to_FourThousand_PSQM	-.114	.005	.010	-.001
	Over_4000_PSSM	-.099	-.010	.006	-.005
	Tract_PCTChange_00_10	.040	-.013	-.087	-.113
	LN_DIST_ALL_RD	.118	-.024	-.025	-.033
	LN_TractJobs2010	-.855	.054	.001	.011
	ATL_MSA_2000	-.024	-.093	-.058	-.086

Correlation Matrix

		DIST_UAZ00_CAT=5.0	DIST_UAZ00_CAT=6.0	DIST_UAZ00_CAT=7.0	DIST_UAZ00_CAT=8.0
Step 1	Constant	-.286	-.267	-.391	-.324
	BorderUAZ00	.546	.490	.680	.527
	DIST_UAZ00_CAT=3.0	.395	.357	.496	.379
	DIST_UAZ00_CAT=4.0	.410	.371	.519	.395
	DIST_UAZ00_CAT=5.0	1.000	.332	.467	.355
	DIST_UAZ00_CAT=6.0	.332	1.000	.427	.324
	DIST_UAZ00_CAT=7.0	.467	.427	1.000	.461
	DIST_UAZ00_CAT=8.0	.355	.324	.461	1.000
	DIST_UAZ00_CAT=9.0	.353	.321	.456	.356
	DIST_UAZ00_CAT=10.0	.306	.279	.397	.310
	DIST_UAZ00_CAT=11.0	.386	.350	.497	.390
	OneHundred_to_FiveHundred_PSQM	.094	.090	.122	.097
	FiveHundred_to_OneThousand_PSQM	-.048	-.051	-.111	-.087
	OneThousand_to_FifteenHundred_PSQM	-.036	-.036	-.074	-.061
	FifteenHundred_to_TwoThousand_PSQM	-.018	-.022	-.057	-.048

	TwoThousand_to_FourThousand_PSQM	-.021	-.027	-.068	-.076
	Over_4000_PSSM	-.017	-.018	-.054	-.050
	Tract_PCTChange_00_10	-.117	-.128	-.197	-.100
	LN_DIST_ALL_RD	-.024	-.029	-.041	-.013
	LN_TractJobs2010	.009	.020	.057	.072
	ATL_MSA_2000	-.083	-.073	-.101	-.080

Correlation Matrix

		DIST_UAZ00_CAT=9.0	DIST_UAZ00_CAT=10.0	DIST_UAZ00_CAT=11.0	OneHundred_to_FiveHundred_PSQM
Step 1	Constant	-.338	-.288	-.358	-.152
	BorderUAZ00	.533	.465	.588	.071
	DIST_UAZ00_CAT=3.0	.379	.330	.414	.109
	DIST_UAZ00_CAT=4.0	.393	.341	.430	.111
	DIST_UAZ00_CAT=5.0	.353	.306	.386	.094
	DIST_UAZ00_CAT=6.0	.321	.279	.350	.090
	DIST_UAZ00_CAT=7.0	.456	.397	.497	.122
	DIST_UAZ00_CAT=8.0	.356	.310	.390	.097
	DIST_UAZ00_CAT=9.0	1.000	.314	.395	.098

	DIST_UAZ00_CAT=10.0	.314	1.000	.347	.084
	DIST_UAZ00_CAT=11.0	.395	.347	1.000	.104
	OneHundred_to_FiveHundred_PSQM	.098	.084	.104	1.000
	FiveHundred_to_OneThousand_PSQM	-.074	-.063	-.095	.126
	OneThousand_to_FifteenHundred_PSQM	-.065	-.058	-.078	.104
	FifteenHundred_to_TwoThousand_PSQM	-.052	-.053	-.067	.089
	TwoThousand_to_FourThousand_PSQM	-.085	-.091	-.104	.118
	Over_4000_PSSM	-.061	-.064	-.076	.100
	Tract_PCTChange_00_10	-.060	-.038	-.004	-.067
	LN_DIST_ALL_RD	-.001	.004	.021	.030
	LN_TractJobs2010	.083	.066	.081	.039
	ATL_MSA_2000	-.064	-.051	-.126	-.038

Correlation Matrix

		FiveHundred_to_OneThousand_PSQM	OneThousand_to_FifteenHundred_PSQM	FifteenHundred_to_TwoThousand_PSQM	TwoThousand_to_FourThousand_PSQM
Step 1	Constant	-.116	-.096	-.082	-.114
	BorderUAZ00	.018	.017	.012	.005

	DIST_UAZ00_CAT=3.0	-.007	.001	.004	.010
	DIST_UAZ00_CAT=4.0	-.034	-.015	-.005	-.001
	DIST_UAZ00_CAT=5.0	-.048	-.036	-.018	-.021
	DIST_UAZ00_CAT=6.0	-.051	-.036	-.022	-.027
	DIST_UAZ00_CAT=7.0	-.111	-.074	-.057	-.068
	DIST_UAZ00_CAT=8.0	-.087	-.061	-.048	-.076
	DIST_UAZ00_CAT=9.0	-.074	-.065	-.052	-.085
	DIST_UAZ00_CAT=10.0	-.063	-.058	-.053	-.091
	DIST_UAZ00_CAT=11.0	-.095	-.078	-.067	-.104
	OneHundred_to_FiveHundred_PSQM	.126	.104	.089	.118
	FiveHundred_to_OneThousand_PSQM	1.000	.141	.117	.157
	OneThousand_to_FifteenHundred_PSQM	.141	1.000	.095	.129
	FifteenHundred_to_TwoThousand_PSQM	.117	.095	1.000	.110
	TwoThousand_to_FourThousand_PSQM	.157	.129	.110	1.000
	Over_4000_PSSM	.121	.100	.086	.119
	Tract_PCTChange_00_10	.007	.008	.006	-.005
	LN_DIST_ALL_RD	-.035	-.051	-.056	-.094

	LN_TractJobs2010	.076	.056	.044	.066
	ATL_MSA_2000	.017	.020	.025	.037

Correlation Matrix

		Over_4000_PSSM	Tract_PCTChange_00_10	LN_DIST_ALL_RD	LN_TractJobs2010
Step 1	Constant	-.099	.040	.118	-.855
	BorderUAZ00	-.010	-.013	-.024	.054
	DIST_UAZ00_CAT=3.0	.006	-.087	-.025	.001
	DIST_UAZ00_CAT=4.0	-.005	-.113	-.033	.011
	DIST_UAZ00_CAT=5.0	-.017	-.117	-.024	.009
	DIST_UAZ00_CAT=6.0	-.018	-.128	-.029	.020
	DIST_UAZ00_CAT=7.0	-.054	-.197	-.041	.057
	DIST_UAZ00_CAT=8.0	-.050	-.100	-.013	.072
	DIST_UAZ00_CAT=9.0	-.061	-.060	-.001	.083
	DIST_UAZ00_CAT=10.0	-.064	-.038	.004	.066
	DIST_UAZ00_CAT=11.0	-.076	-.004	.021	.081
	OneHundred_to_FiveHundred_PSQM	.100	-.067	.030	.039
	FiveHundred_to_OneThousand_PSQM	.121	.007	-.035	.076

	OneThousand_to_FifteenHundred_PSQM	.100	.008	-.051	.056
	FifteenHundred_to_TwoThousand_PSQM	.086	.006	-.056	.044
	TwoThousand_to_FourThousand_PSQM	.119	-.005	-.094	.066
	Over_4000_PSSM	1.000	-.021	-.096	.062
	Tract_PCTChange_00_10	-.021	1.000	-.010	-.063
	LN_DIST_ALL_RD	-.096	-.010	1.000	.062
	LN_TractJobs2010	.062	-.063	.062	1.000
	ATL_MSA_2000	.038	-.250	-.052	.015

Correlation Matrix

		ATL_MSA_2000
Step 1	Constant	-.024
	BorderUAZ00	-.093
	DIST_UAZ00_CAT=3.0	-.058
	DIST_UAZ00_CAT=4.0	-.086
	DIST_UAZ00_CAT=5.0	-.083
	DIST_UAZ00_CAT=6.0	-.073
	DIST_UAZ00_CAT=7.0	-.101

	DIST_UAZ00_CAT=8.0	-.080
	DIST_UAZ00_CAT=9.0	-.064
	DIST_UAZ00_CAT=10.0	-.051
	DIST_UAZ00_CAT=11.0	-.126
	OneHundred_to_FiveHundred_PSQM	-.038
	FiveHundred_to_OneThousand_PSQM	.017
	OneThousand_to_FifteenHundred_PSQM	.020
	FifteenHundred_to_TwoThousand_PSQM	.025
	TwoThousand_to_FourThousand_PSQM	.037
	Over_4000_PSSM	.038
	Tract_PCTChange_00_10	-.250
	LN_DIST_ALL_RD	-.052
	LN_TractJobs2010	.015
	ATL_MSA_2000	1.000

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